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MONTHLY REVIEW

OF THE

Iowa Weather and Crop Service.

VOL. IV.—JANUARY, 1893.—NO. 1.

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CENTRAL STATION, DES MOINES, IOWA.

J. R. SAGE,
DIRECTOR.

GEO. M. CHAPPEL, M. D.,
LOCAL FORECAST OFFICIAL,
U. S. WEATHER BUREAU, ASS'T DIRECTOR.

DES MOINES:
G. H. RAGSDALE, STATE PRINTER.
1892.

THE IOWA WEATHER AND CROP SERVICE

Was established by act of the Twenty-Third General Assembly, and placed under supervision of the Board of Directors of the State Agricultural Society, constituted as follows:

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MONTHLY REVIEW

OF THE

IOWA WEATHER AND CROP SERVICE.

VOL. IV.] JANUARY, 1893. [No. 1.

EDITORIAL NOTES.

This has been a healthy winter. Old Dr. Zero is death on microbes.

***

Jack Frost makes good roads when he is given full sway. A mild open winter is not desirable in this latitude, either for health or business.

***

When the winter's at its height,
And the days are growing bright,
With a minute more of light
As they go;
When the fashionables flee
Southward, leaving you and me,
Then 'tis very apt to be
10 below!

When the snow beneath the wheels
Of the passing wagon squeals,
And a twinging pain one feels
In his toe;
And your beard is frozen stout
As the drip beneath the spout,
Then it's probably about
10 below!

When the furnace heat says "nay,"
And the coalman's lost his "weigh,"
And the milkman brings frappe—
Chalk and snow,
When the washing's just begun,
And the water pipes won't run,
O, it's then we'd like to shun
10 below!

—*The Inter Ocean.*

***

The United States fish commission has just published a report upon the fishes of Iowa, based upon observations and collections made during 1889, 1890 and 1891. The book is by Prof. S. E. Meek, and is an extremely interesting and valuable contribution to the natural history of Iowa. The report takes up each river basin and gives the fish in each. He found 120 different kinds of fish in Iowa, and ninety different kinds in the Cedar river, much the largest number found in any river in the state.

All the streams examined, except a few in the southwestern part of the state, were well supplied with the fishes. With respect, however, to the larger forms, it was often difficult to reach satisfactory conclusions by the use of the ordinary collecting seines. In the bayous along the larger streams young bass, pickerel and various species of sunfishes were always found in large numbers. In the Cedar river pickerel, various species of sunfishes and black bass abound.

***

The trustees of the Agricultural College re-instated Prof. G. E. Patrick in the chair of agricultural chemistry of the Iowa Experiment Station, at Ames. This was done in accordance with the expressed desire of representatives of the leading farmers' associations of the state. Prof. Bennett was also reappointed instructor of chemistry of the College.

***

Iowa still leads all the states in the production of corn and oats, notwithstanding the reduction of acreage and yield last year.

***

Our exports of agricultural products in 1892 amounted to $799,328,232. There will be a considerable decrease in the total for 1893, because of a lessened foreign demand and a shortage in our surplus.

***

Prof. Pammel says the rag weed is a nuisance where the farmer fails to do his duty, but the careful, methodical farmer is not troubled with it. It is readily destroyed under cultivation, permanent pastures or meadows.

***

The Hon. Chas. Aldrich contributes to the Iowa Historical Record an interesting paper on Early Journalism in Iowa. We were especially interested in his record of the abnormal weather prevalent in the winter of 1857 and the summer of 1858. In May, 1857, potatoes were selling at $3.50 a bushel in Webster City. The following autumn they went begging at ten cents a bushel. Wheat sold at twenty cent a bushel, and it was a better article than has been raised in recent years. Corn sold from eight to ten cents, and being cheaper than wood or coal much of it

was burned. The season of 1858 was very wet, with frost every month. There was a succession of thunder-storms and heavy rains all summer, and a killing frost in early autumn. The corn was soft and nearly worthless, and good hay was very scarce the following winter.

***

A dispatch from Odessa, dated January 30, says: "Enormous quantities of snow have fallen in the Dnieper, in Crimea, and in other parts of Russia. In the Dnieper Valley snow is on the level of the house tops. No trains are running in North Crimea, and in one province 100,000 sheep perished."

***

Old Boreas has been striking heavy blows below the banana belt this year.

***

The clerk of the weather is tabulating data preparatory to giving answer to the inquiry: "Are our winters growing milder?"

***

Lake Manasarovara, one of the sacred lakes of Thibet, is over 19,000 feet above sea level and is believed to be the loftiest lake in the world. Two other lakes among the Himalaya mountains, named Chalamoo and Surakol, are 17,000 and 15,400 feet in altitude respectively.

***

In Iowa 29.57 per cent of the farmers are tenants, while in towns 44.96 per cent of the people occupy rented homes. This indicates that the urban population are not so well off as the farmers of the state.

***

Our exports of beef, hog and dairy products for the year 1892 amounted to $135,381,882, as against $120,941,929 in the preceding year.

***

Dr. Geo. M. Chappel, Local Forecast Official of the U. S. Weather Bureau, and Assistant Director of the State Weather and Crop Service, is in Washington, D. C., having been detailed for two months' special service in the forecast division of the general office. In his absence his assistant, Mr. J. S. Hazen, is in charge of the Des Moines station and makes the daily forecasts for Iowa.

***

There have been very many colder winters than this, according to historical data compiled by the St. Louis *Republic:*

"In February, 764, the weather was unusually severe all over Europe; at Constantinople 'the two seas' were entirely frozen over for a period of twenty days. In 1063 the Thames was solidly frozen for fourteen weeks. The winter of 1407-8 was so intensely cold in Britain that all small birds perished. In Germany there was a similar state of affairs. In Baden the rooks gathered in the cities, and actually ate great holes out of the backs of cattle and hogs. It is also recorded that in 1468 the army in Flanders used wine that was regularly cut from the gudgeons with hatchets and distributed in the shape of ice. In 1664 the cold was so intense that ice formed seventy-one inches thick on the river Thames in the heart of London. This beats the prize block now on exhibition in St. Paul by at least one inch. In 1709-10 was the winter known by distinction as 'the cold winter.' All the rivers and lakes in Europe froze solid to the bottom. In Poland and all of north Germany the earth was frozen nine feet deep The Adriatic, the Baltic and the Black seas were all frozen over. Even at Genoa, in 'sunny Italy,' the Mediterranean was frozen for miles out at sea. In 1716 the Straits of Copenhagen were frozen over so that people traveled across on the ice in perfect safety. The winter of 1740-41 was scarcely less severe than that of 1709-10. Snow laid ten feet deep in Spain and Portugal for seven weeks. The Zuyder Zee was frozen over, and thousands crossed it on the ice just for the mere novelty of such an experience. In 1744 snow laid twenty-three feet deep on a level throughout southern Russia. In 1771 the Elbe froze to the bottom, and ice formed five feet thick on the Danube below Vienna.

"In America the record has been almost equally startling. In 1730 and again in 1821 New York harbor was frozen over so solidly that teams were driven in safety over to Staten Island on the ice. Indiana, Ohio and Illinois weather of 1855 was so severely cold that the indicating fluid in the mercurial thermometers congealed solidly in the bulbs of the instruments. The 13th and 24th days of January, 1881, eighty-one persons were frozen to death in the United States. Even as far south as Mobile people who hardly knew what frost meant saw the mercury sink to zero.

***

The Secretary of Agriculture has recently commissioned C. C. Georgeson, professor of agriculture in the Agricultural College at Manhattan, Kansas, to proceed to Denmark, for which country he sailed January 12th, for the purpose of making a thorough investigation of the dairy industry in that country, and preparing a report thereon. His instructions are to cover the entire field of dairying, from the farm to the consumer, paying special attention to those features which have given the Danish products an enviable reputation in foreign countries and so largely stimulated the export of dairy products from that country. Professor Georgeson was selected for this important duty, not only on account of his general fitness for such work, but from the fact that having been born and brought up in Denmark and speaking the language thoroughly, he has exceptional opportunities for a study of the subject in all its details and ramifications.

***

A notable feature of the weather this winter has been the high atmospheric pressure observed in the northwest. On February 4th, the center of the high at Qu' Appelle, Canada, was 31.10 inches, and at Des Moines, the same day, the barometric record was 21.03 inches—the highest on record at this station.

THE IOWA COAL BEDS.

BY CHARLES R. KEYES, ASSISTANT STATE GEOLOGIST.

Among the mineral products of Iowa that of coal takes first rank. The production for the fiscal year ending June 30, 1892, according to the estimates based upon returns furnished by Mr. M. G. Thomas, State Mine Inspector, and from other sources, amounted to more than 5 340,000 tons, valued at $7,750,000. The mining of this great quantity of fuel gives employment to about 9,500 men, whose wages aggregate $5,350,000. Besides, there are probably 8,000 additional men directly dependent for a livelihood upon the coal industry of the state.

The coal mine operators employing ten men and upwards are nearly 400 in number. Smaller owners having less than ten employes probably would increase the total number of separate organizations engaged in mining coal to something over 450.

In regard to the total coal production of the United States, the following table is deduced from Bulletins of the Eleventh Census of the United States:

Pennsylvania	81,700,000
Illinois	12,100,000
Ohio	9,900,000
West Virginia	6,200,000
Iowa	5,000,000
Alabama	3,300,000
Maryland	2,900,000
Indiana	2,800,000
Missouri	2,500,000
Colorado	2,300,000
Kansas	2,000,000

From the foregoing it will be noted that as a coal producer, Iowa ranks first among the states west of the Mississippi river, and fifth among the states of the Union.

Coal Fields of the Interior Basin.—The coal bearing strata of Iowa form the northernmost extension of the great interior coal field of the American continent. This basin comprises northwestern Kentucky, southwestern Indiana, southern and central Illinois, the southern third of Iowa, the northwestern half of Missouri, the extreme eastern border of Nebraska, Kansas and Indian Territory, western Kansas, and extends still further southwestward in a narrow belt into central Texas. The Mississippi river divides the area into two parts: an eastern interior district, including about one-third of the entire basin; and the western interior portion, embracing the remaining two-thirds. Along the dividing line the great water course has cut its channel completely through the coal strata, exposing in a narrow border on each side rocks much older. Everywhere within the limits of the area just bounded, along the borders of the stream outliers of the coal bearing layers are found in ancient gorges and depressions, the connecting beds having been almost completely removed through erosion; leaving only scattered remnants to tell of their once greater extension.

Geographic Limits.—The Iowa coal bearing rocks form the northernmost extension of the great interior coal field. The strata referred to, cover a little over one-third of the entire surface of the state. Geometrically the area is a trapezium with the entire southern boundary of the state forming one side, the Missouri another; an irregularly curved line connecting Keokuk and Ft. Dodge a third; while the fourth or northwesterly side is not as yet well defined on account of the deep deposits of drift materials covering the region, but it is probably approximately along a sinuous line running from Ft. Dodge to Council Bluffs.

Beyond the prescribed boundaries, eastward especially, outliers of coal deposits are scattered even as far north as Jackson county on the Mississippi river. Many of these isolated basins often afford seams of coal sufficiently thick for profitable working.

The coal-bearing rocks of the state as briefly described above are distributed over half the total number of counties in the state. The area covered by these Carboniferous strata is not far from 20,000 square miles. It must not be inferred, however, that the coal is equally distributed over all this district; for such is not the case. The broad belt running southeast and northwest and traversed its entire length by the Des Moines river from Ft. Dodge to Keokuk has heretofore been found to be more productive of coal than other parts of the region. Lately in places outside of this belt coal has been discovered in abundance. And mines are rapidly being opened throughout the area, often where the presence of this commodity was unsuspected before.

All of the coal region of Iowa lies within the limits of the glaciated area and the entire surface is covered consequently with glacial debris, often to a considerable depth. The topography over this part of the state is consequently greatly subdued by the deposits of drift and loess.

Geological Subdivisions.—With the exception of a few carbonaceous seams in the Cretaceous rocks, in the northwestern part of the state, the coal bearing strata of Iowa belong to the median portion of the Carboniferous age, or Coal Measures. The rocks of this formation are made up largely of argillaceous materials, with sandstones and limestones, the coal beds forming an inconspicuous part of the entire series. It has been customary in Missouri and Iowa to subdivide the Coal Measures into—

(3) Upper Coal Measures.
(2) Middle Coal Measures.
(1) Lower Coal Measures.

In considering the Coal Measures as a whole, two tolerably distinct classes of sediments are readily recognized: (1) the marginal or coastal deposits, and (2) the beds laid down in the more open sea.

These two kinds of beds are sharply contrasted lithologically, stratigraphically and faunally. The first is characterized by the rocks being predominantly clay-shales and sandstones, with practically no limestones. The individual beds have usually a very limited extent, and replace one another in rapid succession both laterally and vertically. The sandstones often form great lenticular masses, which are sometimes deeply channeled on the upper surface, the excavations being filled with coal measure clays. These and many other phenomena attest

a constantly shifting shore-line and shallow waters. The fossils contained are nearly all brackish water forms or shore species. The remains of pelagic organisms are not numerous.

On the other hand the second class of beds above mentioned is made up largely of calcareous shales, with heavy beds of limestone. The layers are evenly bedded and extend over very considerable areas. The faunas are chiefly composed of strictly open sea forms.

As the conditions of deposition were evidently those of a slowly sinking shore, the marginal deposits as a whole practically underlie the open sea formations, the former being regarded as the "Lower" Coal Measures and the latter as "Upper" Coal Measures. At the same time it must be remembered that this does not necessarily imply that the "lower" measures are to be considered much older than the "upper"; but rather that along the great and successive planes of sedimentation different kinds of beds in the upper and lower divisions were laid down contemporaneously.

With this idea of the Coal Measures of the interior basin the limits of the formation in Iowa assumes somewhat different lines from those that have commonly been recognized.

It is proposed, therefore, to divide the Coal Measures or Upper Carboniferous into:

(2) The Upper Coal Measures or Missouri Stage.

(1) The Lower Coal Measures or Des Moines Stage.

The Des Moines formation represents the lower Coal Measures or marginal deposits of the Upper Carboniferous. It takes its name from the Des Moines river which flows for more than two hundred miles directly through the beds of this terrane. It extends into Missouri along the northern and western boundaries of the Ozark mountains, continuing southwestward into Kansas and Indian Territory.

The Missouri formation corresponds essentially to the upper Coal Measures representing more strictly marine deposits. It is the formation typically developed in the northwestern part of Missouri. The Missouri river also winds its way for more than four hundred miles through the beds of this stage, exposing numerous fine sections on both sides of the stream throughout the entire distance.

Character of the Coal Measures.—In the order of their abundance the rocks of the Coal Measures are clay shales, sandstones, limestones and coals. The secondary part that the Calcareous beds play in the Coal Measures of the state, especially in the lower division, contrasts this formation with the other palæozoic rocks. Below, the Coal Measures rest on a great basement of massive limestone, with but few clay or sandy beds of separation. Not less striking is the relative thinness, as a rule, of the individual layers which replace one another upwards and laterally in rapid succession. If the upper and lower divisions of the Coal Measures in Iowa were to be contrasted upon lithological characters, it would be found that the former is prevailingly lime bearing; the latter largely clayey.

Lower Coal Measures.—As already stated the clay shales make up by far the greater part of the formation as represented in Iowa. On exposure to atmospheric agencies the shales rapidly disintegrate forming soft clays which are easily carried away by running waters. For the most part they are gray, ashen or black in color, though red, yellow, buff and blue shales are not of uncommon occurrence. The shales may be argillaceous, arenaceous, calcareous or bituminous.

As already stated the sandy material present in Coal Measures of the region under consideration is usually mixed with clay to such an extent as to actually form sandy shales. In some cases, however, the sand constitutes a rock which is sufficiently hard to form material for ordinary rough masonry. The hard portions of the sandstones are for the most part very limited, being only two or three feet in thickness or in the form of hard concretionary masses in a soft matrix.

The limestones of the Lower Coal Measures play an unimportant part in the lithological features of the region. They consist merely of a few thin bands chiefly in the upper portion of the section and seldom exceed ten or twelve inches in thickness. The calcareous beds are the most persistent and easily recognizable over wide areas of all the horizons in central Iowa.

Little need be said here concerning the character of the coals of the state. They are all of the bituminous variety. The carbonaceous seams vary from a few inches to seven or eight or even ten feet in thickness; the average of the veins at present worked being between four and five feet. These beds are deposited not in two or three continuous layers over the entire area as has been commonly supposed but in more or less lenticular masses varying from a few feet to several miles in extent.

Upper Coal Measures.—As in the lower division of the Iowa Coal Measures the argillaceous material of the upper part predominates over the other components, but the clays are largely calcareous rather than bituminous.

The limestones assume a very important part in making up the Upper Coal Measures. They also constitute the most striking lithological distinction between the upper and lower divisions. In thickness the beds vary from a few inches to twenty or thirty feet and upwards. The recognition becomes greatly simplified through the wide presistence of the limestone layers which are thus valuable aids in accurate correlation.

The sands of the Upper Coal Measures are largely disseminated through clays forming sandy shales or shaley sandstones. Massive sandstones are not uncommon. They are chiefly confined to the lower layers and are only a few feet in thickness. Over large parts of the Upper Measures coal seams of economic importance are not common. Deep borings, however, will probably disclose a large amount of workable coal, as at Leavenworth, Kansas, and neighboring places.

Variability of Strata.—In considering the stratigraphical features of the Lower Coal Measures the conclusion will probably be reached that all of the beds present great variability. Such is indeed the case. In fact it is one of the most striking characteristics of the formation as represented in Iowa. The rapid passage from one bed to another lithologically very distinct is everywhere ap-

parent, the transition taking place vertically in different layers or laterally in the same horizon.

Thickness of the Coal Measures.—For reasons which need not be stated in detail here, considerable difficulty is encountered in working out the structural features of the Coal Measures in Iowa. The general inclination of the beds is to the southwestward. Careful estimates indicate that the greatest thickness of the Lower Coal Measures in the state is probably in the neighborhood of 400 feet, and that the maximum vertical measurement of the upper division more than thrice that figure. Erosion has largely removed the coal bearing strata of this district, and the original thickness of these rocks is not now present at any one place.

Extent and Character of Individual Coal Beds.—There is an opinion prevalent among the miners of the state that there are only three workable coal horizons. These are usually designated as the "first," "second" and "third" seams. Should any subordinate seams be encountered in the sinking of a shaft they are not taken into consideration. As a matter of fact the "three" veins are not continuous over areas of any great extent, and may have widely different stratigraphic values, even within very short distances. The "first," "second" and "third" seams of one shaft may be entirely distinct from the similarly called seams of another mine scarcely half a mile away. A noteworthy instance for citation in this connection is a boring made near the city of Des Moines. It was two hundred feet in depth. Twelve distinct coal horizons were met, giving a total thickness of coal of thirteen and one-half feet; yet none of the beds were thick enough for profitable working. Only one-third of a mile away was a mine removing coal from two seams, one of which was four to five feet in thickness.

The stratigraphical importance of the coal seams is not so great as has generally been supposed, since the individual beds are, with very few exceptions, comparatively limited. Only a single case is at present known in which the geographic extent of a coal stratum is more than four or five miles, and for the greater part of this distance the coal is but a few inches in thickness. On the other hand the total amount of coal in the state is probably very much greater than has been commonly regarded.

The basal coal seams in the Lower Coal Measures of Iowa appear to be more extensive than those toward the top, where they are only a few inches in vertical measurement and perhaps a hundred yards in extent. The coal may therefore be regarded as disposed in numerous basins of greater or less area, thickened centrally, but gradually becoming attenuated toward the margins. These are arranged in various horizons, interlocking with one another, but separated by varying thicknesses of sandstone and shale. Thus at any one point a dozen or more seams may be passed through in sinking a shaft, only two or three perhaps being workable.

The disposition of the coal in numerous limited lenticular basins instead of a few layers extending over broad areas is of the utmost importance from a purely economical standpoint. In all mining operations and in all prospecting it is very essential that this fact be kept constantly in mind. With methods of boring more modern than those commonly in vogue throughout the western states there is every reason to believe that in the Lower Coal Measures especially, the large majority of good coal seams twelve inches in thickness and over encountered in prospecting can be traced readily and easily to localities where they are thick enough for profitable working.

Interrupted Continuity of the Coal Beds.—In Iowa the restrictions upon the distribution of the individual seams are not numerous as compared with other regions. Yet there are disturbances of various kinds which break the continuity of the coal strata, locally interferring seriously with mining operations. They are referable to the three general agencies of deposition, erosion and dislocation.

The irregularities of deposition are due (1) to unevenness of the floor and (2) to presence of varying currents at the time the beds were laid down. The effects of the inequalities of the bottom—the result of erosion or other causes—are to terminate the coal layers abruptly against a wall in an old channel or gorge; to cause a rapid thinning and disappearance of the bed as in the neighborhood of an ancient elevation; to subdivide a coal basin, as when sharp ridges traverse the area. Or, the converse of these results are effected in all these cases where depressions are present instead of elevations, causing a local increase in the thickness of the coal. The existence of former currents results in unequal accumulation of bituminous material.

The most serious interference with the continuity of coal beds arises from erosion. The erosive effects of later geological or post-glacial times are easily inferred from the present topography of the region, and cause but little embarrassment in mining operations. The work of preglacial degredation cannot be read from existing topographical features. Some of the most familiar phenomena of this kind are met with in mines and old channels filled with sandstone or shales that cut off abruptly the thickest coal veins, as is shown in the old Polk County Coal Mine near Des Moines.

AN IOWA VOLCANO.

BY CHARLES R. KEYES, ASSISTANT STATE GEOLOGIST.

The rocks of Iowa are so horizontal in their position, so undisturbed by mountain making forces, and so unaltered in lithological characters, that it is generally supposed that all the strata of the state are essentially the same as when deposited in waters of the great interior sea which once occupied the heart of the American continent. But in the extreme northwestern corner of the state there is a small area of crystalline rocks, commonly known as the Sioux Quartzite or Sioux Granite. This rock is exposed in large outcrops in the neighboring parts of Dakota and Minnesota. It is a hard vitreous mass with undulating bedding planes. The geological age of the Sioux Quartzite is regarded as much greater than that of any other formation, not excepting the old Cambian sandstones of northeastern Iowa.

Although the area of the Sioux quartzite is quite extensive no other crystalline rocks have been noted in the neighborhood until very recently. It is, then, of considerable interest to know that there has been discovered in the midst of the Sioux quartzite of southeastern Dakota, in Minnehaha county, within three miles of the Iowa boundary, a large mass of trap which is reported to extend for more than a mile along one of the tributaries of the Big Sioux river. A microscopical examination of these rocks shows it to be a well pronounced coarse-grained olivine diabase with such minerals as hornblende, black mica and apatite present in addition to the feldspar, augite and olivine.

The presence of this massive basic rock of unmistakable eruptive origin is very suggestive of the agencies that have been at work to some extent in changing the old sandstone. Further investigations will doubtless disclose other similar types of intrusive rocks in the Sioux quartzite in all three of the states already mentioned.

But the occurrence of this black trap rock, which has undoubtedly been cooled from a molten condition, is made even more interesting by other discoveries of still more recent date. During the past few years a number of deep wells or borings have been made at different places in northwestern Iowa. The depths reached are from 1,200 to 2,000 feet. Several of these borings are of special interest, inasmuch as they pass through all of the sedimentary rocks into the crystalline beds below, penetrating them in some cases to the extent of several hundred feet. A typical gray granite has been recognized in some instances; in others, different types of eruptive rocks. One of the latest borings in this part of the state is the well at Hull, in Sioux county. At a very considerable depth a number of beds of flint-like rock were passed through. The different layers were separated by sand and gravel several feet in thickness, if the records are to be relied upon. Some of the flint-like fragments were sliced by Mr. Beyer, and upon microscopical examination proved to be what is known to geologists as quartz-porphyry—a truly igneous rock or lava, very acid in character and essentially identical with granite but cooling under somewhat different physical conditions.

The presence of the several sheets of quartz-porphyry, which are to be regarded as different lava flows, show conclusively that volcanic forces were very active in northwestern Iowa in ancient times. The position of the lava beds seem to indicate, as will be pointed out by Mr. Beyer in his report on the subject, that the flow of the molten rocks probably took place toward the close of the Carboniferous age immediately after the coal of the Mississippi basin had been deposited.

Mr. Beyer puts forward, therefore, two explanations:

(1) That the flow took place during palæozoic time, perhaps in the Carboniferous, the lava being secularly poured out over an old sea bottom.

(2) That as a whole the different flows were contemporaneous and in point of time post-Carboniferous. In this case the intercalations are to be regarded as the results of the subterranean lava flows—the lava following along lines of least resistance and flowing between the strata.

It makes little difference which of these two views are accepted, for certain it is that here in northwestern Iowa there is every reason for believing that there was at one time active volcanic agencies at work not unlike those seen to-day in southern Europe around the shores of the Mediterranean sea.

DAIRY SCHOOL IN IOWA.

Although it is only a little over a year since the dairy building at the Iowa Agricultural College, Ames, Iowa, was completed and opened for the admission of students, the dairy education given here has become so popular we are getting about as many students as we can conveniently handle with our present facilities. One of the problems that came up for solution during the past summer was how we could do the most good and be of the greatest benefit to those students who came before and after the regular dairy school that begins the first of December and continues for twelve weeks. As we have in operation a butter and cheese factory the year round, and consequently handle a large amount of milk during the summer months, we received applications from a number of young men who could attend the school most conveniently during the summer months. We have admitted such and given them thorough work in the practical side, allowing them to work continually with those having charge of commercial side of creamery, but for want of educational force we have been unable to give them little more than a thorough drilling in all that pertains to practical dairy work. Now, however, the board of trustees having provided for the educational side by the election of a specialist in dairy work, we will be able to be of as much benefit to the summer student as the one who comes in the winter, and have decided to conduct three dairy schools during the year instead of but one. The first of these schools will begin March 1st, the second August 1st, and the third December 1st, as heretofore. Students attending the summer schools will be given thorough drill in the practical dairy work both with cheese and butter, and Prof. Wallace will deliver to them a special course of lectures dealing with every phase of the dairy question from the cow to the churn and curing room. In addition to this the students who enter at the beginning of the term will have the opportunity to attend the classes of the regular four year course and take lectures on breeding, breeds of live stock, feeding or any others that they may elect, thus giving them an opportunity to devote the major part of their time to dairy work and at the same time obtain a much broader education than they could at other seasons of the year. Especial attention will be given to farm dairying during these summer schools, thus giving the younger boys and girls a chance to get a thorough knowledge of dairying that they can take home and apply. No entrance examinations will be required of those who enter either of these dairy schools, and we hope to see them fill up rapidly with bright young men and women from the farms of the west.

JAMES WILSON.

Iowa Agricultural College, Ames.

NEW IOWA STATISTICS.

The assessors throughout the state are calling the attention of the farm owners to the law passed by the general assembly with reference to crop statistics. It was provided that in each odd year, when the real estate assessment is made, the assessors should require each owner to answer questions in regard to all the principal crops raised; also the number and acreage of pastures, artificial and natural groves, nurseries, orchards vineyards, and the number of horses, mules, cattle, sheep and swine. The assessor is ordered to make a complete return on these matters to the county auditors before the third Monday in May. These statistics have nothing to do with the assessment proper, and are entered in a separate set of books. The object of their compilation is obvious. It is believed that full and complete exposition of the agricultural product of a state, if a like work is taken up in other states, besides being interesting in itself, will go far to break down any artificial depression in prices through wholesale misrepresentation and overestimate. The agricultural department has for years endeavored to collect this information, but its estimates have been based upon estimates, and however close they may have approximated to reality, there has been sufficient doubt as to their accuracy to deprive them of their full weight. In fact, there has been a quite general opinion that the bureau officer has usually overestimated, and has thus acted as a bear on the market. So far as Iowa is concerned definite data gathered at first hand will be prepared every two years, and after the law has been in operation a few years, it is expected that it will be possible to predict with mathematical exactitude the surplus Iowa each year will have to sell.—*Sioux City Journal*.

THE IOWA AGRICULTURAL EXHIBIT.

Having been appointed by the Iowa Columbian Commission to take charge of the work of collecting and installing an exhibit of such products and articles as are embraced in the Department of Agriculture, including the dairy industry, the apiary, and agricultural machinery, I beg to call your attention to the great prominence Iowa has already attained as an agricultural state, and the importance of having an exhibition of our soil and the very best of the products of our soil, the finest specimens that can be produced from our creameries and the dairy, and an exhibit of the honey we produce, at the World's Fair, and thereby attract the attention of the millions of visitors to that great exposition, to Iowa and to her wonderful resources and possibilities in the line of agriculture.

The question is sometimes asked, "Have the farmers and producers any interest in making this kind of an exhibit?" Most certainly, yes. All classes will be benefited, but I believe the farmer more than any other. Iowa is now only in its infancy. We know our soil and its producing qualities; we now stand first as a corn producing state, and, without doubt, will always grow more corn than any other state in the union (to say nothing of our $150,000,000 worth of other farm products grown annually in Iowa) but the greater the production the worse off we are unless we can find more consumers.

The World's Fair is the great opportunity of our generation to show to the whole world what we produce, and to induce the people of the world to use it. The increased consumption in this and other countries, making a greater demand for export, will surely give the farmer what he so much needs and most earnestly desires—a *good price* for his corn and other farm products. In 1891, Iowa produced 350,000,000 bushels of corn. If we increase the price only 5 cents per bushel, by this exhibit it would add to the Iowa farmers' pocket money $17,500,000 annually. We ask your hearty co-operation.

First. To aid in making a creditable collective exhibit of our products in the Iowa State Building now being erected on the World's Fair grounds.

Second. To aid in making an exhibit in the various classes in the competitive departments in the agricultural and dairy buildings.

For an exhibit of farm and garden products, in the Iowa State Building, we must have the very best samples that Iowa can produce. We are all alike interested in this and we solicit specimens of any of the following products:

1. Shelled corn, any kind, 2 quarts of each variety.
2. Corn in the ear, any kind, not less than six ears of each variety.
3. Corn in the ear witth a few husks attached.
4. Grains, all kinds, threshed, 2 quarts each variety.
5. Farm, garden and flower seeds, from ½ pint to 1 quart each.
6. Grains of all kinds, in straw, full length, part with roots attached; tied in bundles about 1½ inches in diameter.
7. Grasses of all kinds put up same as grains in straw.
8. Flax and flax seed, flax fiber, millet, broom corn with seed, and in the brush.
9. Specimens of anything in the bee industry, and apiary supplies.
10. Honey in comb and extracted.
11. Amber cane and sugar and syrup manufactured from the same. One gallon of syrup and not less than 5 pounds of sugar.
12. Beet sugar, not less than 5 pounds.

Any of the samples contributed can, if desired, have the name of the individual or county placed upon the exhibit.

Small cotton sacks for grain and seeds, also tags, will be furnished upon application to me.

When samples or anything for exhibition are ready for shipment, write for full shipping directions. (Make no shipment without first writing for shipping directions) and full information will be sent. Freight will be paid by this department on all samples furnished as part of the state exhibit.

It is hoped that the secretaries and other officers of county and district agricultural societies will secure from exhibitors at their respective fairs, as many samples as possible, bearing in mind that it is *best quality* and not quantity that is wanted. Such exhibits as are secured in

this way will be taken in charge by the secretary, and any expense for storing and draying will be paid by this department.

The exhibit in the state building is to advertise the resources of the state, and will not be classified.

Articles for competition in the various exposition buildings in the several departments, will be classified and shown under the rules of the exposition management.

The following are some of the rules issued by the board of management of the exposition, in the classified departments:

Rule 10. Exhibits of cereals, and other farm products, *must* be accompanied with the following data and information:

a. Name of object.
b. Name of producer.
c. Place where grown.
d. Character of soil.
e. Date of planting.
f. Quantity of seed planted per acre.
g. Method of cultivation.
h. Date of harvesting.
i. Yield per acre.
j. Weight.
k. Price of product at nearest home market.
l. Average temperature by months for the time intervening between planting and harvesting.
m. Average rain or snow-fall by months for the time intervening between planting and harvesting.
n. Was exhibit produced by irrigation?

DAIRY DEPARTMENT.

11. Dairy products will be received for exhibition only between the first and tenth of the following months: June, July, September, and October, 1893.

12. The arrangement of all dairy exhibits will be under the control of this department.

APIARY DEPARTMENT.

1. Exhibits of honey will be classified as follows:

Class 1. Clover and Basswood.
Class 2. White Sage.
Class 3. Buckwheat.
Class 4. All light honey, other than enumerated in Classes 1 and 2.
Class 5. All dark honey, other than enumerated in Class 3.

2. Exhibits of honey produced during 1892, or earlier, must be in place on or before April 28, 1893.

3. Exhibits of honey in classes 1, 2 and 4, produced during 1893, will be received between July 15th and August 15th; and in classes 3 and 5 between August 15th and September 1, 1893.

4. The following information should accompany each exhibit:

a. Kind of honey.
b. Name of exhibitor.
c. Place where produced.
d. Character of soil in locality where produced.
e. Variety of bee.
f. Name of plant from which the honey was produced.
g. Yield per colony.
h. Average price of product at nearest home market.

5. In order to secure a uniform, handsome and economical installation of honey and beeswax, the exposition will erect suitable glass cases, of a uniform character, in which such exhibits will be made; the cost of these cases to be borne by the different state commissions, bee keepers' associations, or by individual exhibitors, in proportion to the number of lineal feet occupied. These cases will become the property of such exhibitors at the close of the exposition.

The dimensions are as follows: Height of base 18 inches; width of case, 5 feet; height of case above base (inside measure), 6 feet; total height, 8 feet. The case has sliding doors on both sides.

6. Individual exhibits of comb honey will be limited to 100 pounds, and may be made in any manner the exhibitor may desire, subject to the approval of the chief of the department.

7. Individual exhibits of extracted honey must be made in glass, and must not exceed 50 pounds.

8. Individual exhibits of beeswax must not exceed 50 pounds, and should be prepared in such a manner as will add to the attractiveness of the exhibit.

9. Exhibits of primitive or modern appliances used in bee culture, both in this country and abroad, will be received, subject to the approval of the chief of the department.

10. Special arrangements will be made by the chief of the department for a limited exhibit of bees.

11. Collections of honey-producing plants, suitably mounted and labeled, will be accepted if satisfactory to the chief of the department.

Further information in regard to exhibits in the agricultural, dairy and apiary departments. Also the general rules issued by the exposition management, governing the exhibits in the competitive departments and classes, will be sent on application to

F. N. CHASE,
Commissioner in charge of Dept. of Agriculture.
Cedar Falls, Iowa.

NATIONAL WEATHER CROP BULLETIN—JANUARY, 1893.

The month of January has been colder than usual throughout the Mississippi and lower Missouri valleys and thence eastward to the Atlantic coast, the greatest departure from the normal being over the northern portion of the south Atlantic States, and over the States of the Ohio Valley, where the average daily temperature ranged from 10° to 12° below the normal for January.

The temperature was from 5° to 10° below the normal throughout New England and the Lake region, and from 3° to 4° below on the north Pacific coast, and in northern California.

The month was warmer than usual throughout the

entire Rocky Mountain region, the excess in temperature ranging from 6° to 12° per day from Texas northward to Montana.

PRECIPITATION.

During the month of January the precipitation was less than usual, excepting limited areas in the Lake region and in the western portions of North Dakota. In all other sections there is a marked deficiency, especially throughout the greater portion of the Southern and Atlantic states. Over the greater portion of the cotton region the deficiency in rain-fall for the month exceeded three inches. In all states on the Atlantic coast the rainfall deficiency exceeded one inch, while on the Pacific coast the deficiency ranged from one to six inches north of San Francisco, and from one to three inches on the southern California coast.

GENERAL REMARKS.

Although the weather was unusually cold over the principal agricultural districts east of the Missouri and lower Mississippi valleys, the accompanying special reports indicate that winter wheat has, so far, escaped without material injury, although some damage may have resulted to the crop in sections where the crop has not been protected by snow.

At the close of the month the greater portion of the winter wheat region was unprotected by snow and a severe cold wave is now passing over this section.

FARM ANIMALS.

The report of the statistician on the comparative numbers and values of farm animals based on returns to January, 1893, is nearly ready for publication. It shows an increase in horses, mules and sheep; no material change in the number of milch cows; a decrease in oxen and other cattle, and a very heavy reduction in the number of swine. The estimated number of domestic animals on farms, ranches and public range is as follows:

Horses	16,206,803
Mules	2,331,128
Cows	16,424 087
Other cattle	35,954,186
Sheep	47,252,552
Swine	46,094,887

The average values have declined as to horses and mules and advanced as to cattle of all kinds, a great gain appears in the value of sheep, and a very large advance is seen in swine, amounting to 30 per cent and progressive since the returns were made. The average value of horses is $71.22; mules, $70 68; cows, $12 75; other cattle, $15.24; sheep, $2.66; swine, $6.41. The increase in the aggregate values as estimated of all farm animals is from $2,461,755,678 to $2,483,506,676. The valuation of horses aggregates $992,225,185; cattle of all kinds, $905,181,984; swine, $295,468,225; sheep, $125,909,264; mules, $164,763,751.

It will be seen from the foregoing statement that there was a marked decrease in the number of swine. Last year's report showed 52.398,000 hogs in the country, indicating a shortage this year of 6,303,113. This is the greatest drop ever known within a single year, and it can not fail to have a stiffening influence upon prices. The June report of this bureau showed a decrease of 25 per cent in the spring pig crop in Iowa. Similar conditions of weather caused a shortage in all the great swine breeding sections of the country.

JANUARY WEATHER REPORT.

The month of January, 1893, will rank among the coldest winter months on record in Iowa. The mean temperature at Des Moines has been lower in two Januarys since the station was established. At Davenport and Dubuque the mean of the month was as low as has been noted within the past twenty-two years. The eastern half of the State averaged about five degrees colder than the western half.

The mean temperature of the State, 9.3°, was about 7° below the normal for the month.

The average precipitation, .74 of an inch, was about half the normal amount. The bulk of it came in the form of snow, and the eastern districts received much the larger portion.

The following table gives, as a basis of comparison, the mean temperature and total precipitation of the month of January at the stations named, for the years from 1872 to 1893 inclusive:

YEARS.	MEAN TEMPERATURE, DEGREES.						PRECIPITATION, INCHES.					
	Des Moines.	Davenport.	Dubuque.	Keokuk.	Omaha.	Sioux City.	Des Moines.	Davenport.	Dubuque.	Keokuk.	Omaha.	Sioux City.
1872	....	....	....	25.0	19	....	....	0.13	....	0.07	0.08	....
1873	....	17	....	16.4	17	....	....	3.56	.....	3.40	0.64	.....
1874	....	24	21	25.9	22	....	....	4.34	2.45	3.92	0.32	.....
1875	....	9	7	16.3	11	....	....	0.38	1.00	0.61	0.26	.....
1876	....	30	28	34 2	27	....	....	3.47	3.20	0.68	0.22	.....
1877	....	17	15	22.2	20	....	....	1.41	0.96	0.84	0.53	.....
1878	....	30	28	33.0	29	....	....	0.36	0.49	0.17	1.13	.....
1879	18.9	18	17	20.8	22	....	0.69	0.79	0.44	0 50	0.07	.....
1880	36.2	38	34	41.2	34	....	0.70	3 13	1.95	3.91	0.90	.....
1881	14.0	14	12	18.2	12	....	1.55	1.34	1.87	0.50	0.61	.....
1882	26.7	29	24	28.5	28	....	0.63	0.90	0.84	1.07	0.74	.....
1883	8 8	16	10	16.4	12	....	1.72	1.16	1.59	1.24	1.01	.....
1884	16.0	19	14	18.9	17	....	0.85	0.75	0.99	0.85	0.73	.....
1885	11.5	17	12	16.1	12	....	1.00	2.10	1.80	2.44	0.41	.....
1886	10.9	13	13	15.0	7	....	3.47	2.22	3.17	2.08	1.15	.....
1887	11.5	13	11	18.9	12	...	0.83	1.43	3.33	1.48	0.49	.....
1888	06.9	10	7	14.7	8	....	1.15	1.54	1.20	1.57	0.58	.....
1889	21.0	25	22	28.3	24	....	1.22	0.95	1.55	1.89	1.62	.....
1890	20 6	27	22	29.3	18	14.0	2.62	2.49	2 31	1.81	1.44	1.14
1891	28.3	28	27	31 7	30	27.5	1.82	2.38	1.27	2.59	2.11	1.66
1892	17.8	17	15	19.6	18	14.7	1.60	1.60	2.34	1.96	0.42	0.41
1893	10.2	9	7	14 2	16	12.6	0.56	1.14	1.60	0.92	0.28	0.34
Means	17.3	19.0	17.0	21.0	19.0	17.2	1.36	1.71	1.71	1.69	0.71	0.89

SUMMARY OF WEATHER CONDITIONS.

BAROMETER— Mean pressure for the month, 30.13 inches. Highest observed, 30.61, at Omaha, on the 15th. Lowest observed, 29 56, at Sioux City, on the 21st. Range for the State, 1.05 inches.

TEMPERATURE—Monthly mean, 9.3°; highest monthly mean, 18.2°, at Glenwood; lowest monthly mean, 1 6°, at Delaware. The highest temperature reported was 54°, on the 4th, at Glenwood. The lowest temperature reported was—34°, at Decorah, on the 14th. Average daily max.

imum, 19.5°; average daily minimum, 0.7°; average monthly maximum, 40.1°; average monthly minimum, 16.4°. Greatest monthly local range, 75°, at Charles City; least local monthly range, 49°, at Grinnell; average monthly range, 57°.

PRECIPITATION—Average for the State, 0.74 inches. The greatest amount reported, 3.20, at Havelock; least amount reported, 0.13, at Larrabee; average number of days on which .01 or more fell, 5.8.

MISCELLANEOUS — Average number of cloudy days, 11.2; partly cloudy, 9.4; cloudless, 10.6.

HALOS—Newton, 12th, 31st; Iowa Falls, 4th; Greenfield, 12th; Blakeville, 2d, 9th, 14th; Ames, 9th, 14th, 26th, 20th; Alta, 9th, 12th, 22J, 23d, 26.h, 28th.

HIGH WINDS—Keosauqua, 3d, 12th; Indianola, 5th; Eagle Grove, 29th, Alta, 31st.

HAIL—Iowa City, 29th.

THUNDER STORM—Eldora, 28th, Richland, 15th.

AURORA—Alta, 21st, at 10 A. M., low faint arch, with no streamers; Cresco, 24th.

ATMOSPHERIC PRESSURE.

STATIONS.	Mean actual barometer.	Mean reduced barometer.	EXTREMES.			
			Highest barometer	Date.	Lowest barometer	Date.
Cresco	.....	.....	.....	.....	.....	.....
Davenport	.....	30.11	30.43	26	29.59	9
Des Moines	29.12	30.14	30.52	26	29.65	4
Dubuque	.....	30.08	30.46	26	29.59	8
Grinnell	.....	30.14	30.51	15	29.63	8
Keokuk	29.38	30.10	30.46	26	29.61	4
Omaha, Neb	.....	30.16	30.61	15	29.62	31
Sioux City	.....	30.14	30.58	26	29.56	21
Average	29.25	30.13	30.61	26	29.56	21

WIND MOVEMENT.

STATIONS.	Miles.	Maximum velocity.	Direction.	Date.
Davenport	7,338	38	N W	5
Des Moines	6,196	37	N W	5
Dubuque	3,088	26	N W	5
Keokuk	5,659	25	N W	24
La Crosse, Wis	4,693	36	N	9
Omaha, Neb	6,315	35	N W	9
Sioux City	8,622	43	N W	31

OBSERVERS' NOTES.

Monticello. HENRY D. SMITH—There was a faint solar halo, two sundogs at sunrise January 18th, and a bright lunar halo from 7 to 8:30 P. M., on the 29th. Frost every day. The maximum temperature for January since 1854 was 62° in 1855; minimum —33° in 1884. The normal for the month is 14 77°. The maximum precipitation for the month was 3.77 inches, in 1866; minimum 0.20, in 1865; normal, 1.65 inches. The maximum snowfall was 28½ inches in 1861; minimum .00, in 1857; normal, 8.43 inches. The years of lowest mean temperature for January were 1875, 3.6°; 1883, 6.41°; 1885, 5.9°; 1888, 6.76°.

Amana. CONRAD SCHADT—Many fish came down the river from the beginning of the month. Toward the close of the month many dead ones were among them. Rivers and ponds were too much frozen over. The water has a foul smell. There was a sudden change of temperature on the last day of the month from 33° at 5:30 P. M., to 6° at 8 P. M., and —12° at 7 A. M. next morning.

Fort Dodge. R. W. BLAIN—Weather record for January, 1893. Number of clear days, 9; partly cloudy, 9; cloudy, 13. Temperature below zero at 7 A. M., 13 times; below at 1 P. M., two days. Lowest temperature observed, 14° below zero; highest, 33° above. Wind blew at a velocity of 20 miles an hour one day; at 15 miles one day, and at 10 miles three days. Snowfall, 4⅛ inches, badly drifted. The severity of the weather draws heavily upon the stock feed of all kinds, and but little will be left for marketing.

Clinton. DR. LUKE ROBERTS—The behavior of January, 1893, was very cold—no time being given for the customary January thaw—the ground being covered continuously with snow, affording fine sleighing during the entire month.

The cold Januarys since 1839, were in 1856, 1857, 1875, 1883, 1888 and 1893. January, 1893, was the coldest of them all save that of 1883, ten years ago, which only went three-tenths of a degree lower.

Sixteen degrees is a normal temperature for January for the last 15 years. The mean temperature for January, 1893, was 8.1°—about 8° below normal. The month was almost continuously cold throughout, the highest temperature only reaching 39°. This was on the 24th. The minimum was 20° below zero, on the 17th. The temperature was below zero on 20 different days during the month, ten of these being consecutive, from the 10th to 19th inclusive. The maximum passed above 32° only twice during the month, on the 24th and 31st.

While January, 1893, is a close companion to that of 1883 its severity will hardly compare favorably. The maximum temperature for January, 1883, was the same as in 1893, but the minimum was 12 degrees lower than in 1893.

The five days of January 1883, from the 19th to the 23rd, inclusive are without a parallel in Iowa records; the temperature of the air remaining continuously below zero. The mean temperature of the 20th was 11° below zero; 19 5° below on the 21st; 21 5° below on the 22nd and 13° below on the 23rd.

The days on which the mean temperature was below zero during January, 1893, were the 10th, 13th, 14th, 15th, 16th and 26th, but the lowest of these was only 8.5° below zero.

The temper of the wind during January was such as not to bring blizzards or drift snow badly to the detriment

of roads. The total movement during the month was 4,550 miles against 6,580 miles for the cold January of 1883.

The maximum velocity was 27 miles an hour.

The mean cloudiness was 50 per cent of the surface of the sky. The number of cloudy days was 7, clear days, 6, fair days, 18, storm days 10 and mainly snow. Depth of snow fall, 14 inches. Total precipitation (snow melted) 2.01 inches.

On the 28th a steady, misty rain was falling all day, forming a crust on the snow and ice on trees and shrubbery. Walking became slippery and dangerous.

The mantle of snow covering the ground is counted favorable for grains sowed in the fall and also for prospective crops to be seeded in the spring. The ground is said to be but little frozen on grassy fields.

Depth of snow on ground at close of month, twelve inches.

Fayette. R. Z. LATIMER—Mean temperature for the month, 6°. Mean max. temperature for the month, 16°. Mean min. temperature for the month, 5.45°. Maximum temperature on the 9th, 32°. Minimum temperature on the 17th, 24° below. Twenty-two days in the month the temperature dropped below zero, and on the 9th, 14th and 26th the temperature did not reach above zero. Total precipitation (melted snow). 1.05. Depth of snow on the ground on the 15th, 13 inches. Depth of snow on the ground at the end of the month, 19 inches. Snow fall during the month, 12.2 inches. Prevailing wind, northwest. Number of clear days, 11; partly cloudy, 7; cloudy, 13. Observation taken at 7 A. M. showed the temperature below zero 16 times, at 1 P. M 4 times, and at 9 P. M. 12 times.

Iowa Falls. J. B. PARMLEE—Very bright parhelia all day the 14th. Mercury dropped 52° between 3. P. M. 31st and 6 A. M. February 1st.

Clarinda. A. S. VANSANDT — January, 1893, is the coldest month since records of this station began--1888.

SOLAR OBSERVATIONS, JANUARY, 1893—ALTA, IOWA.

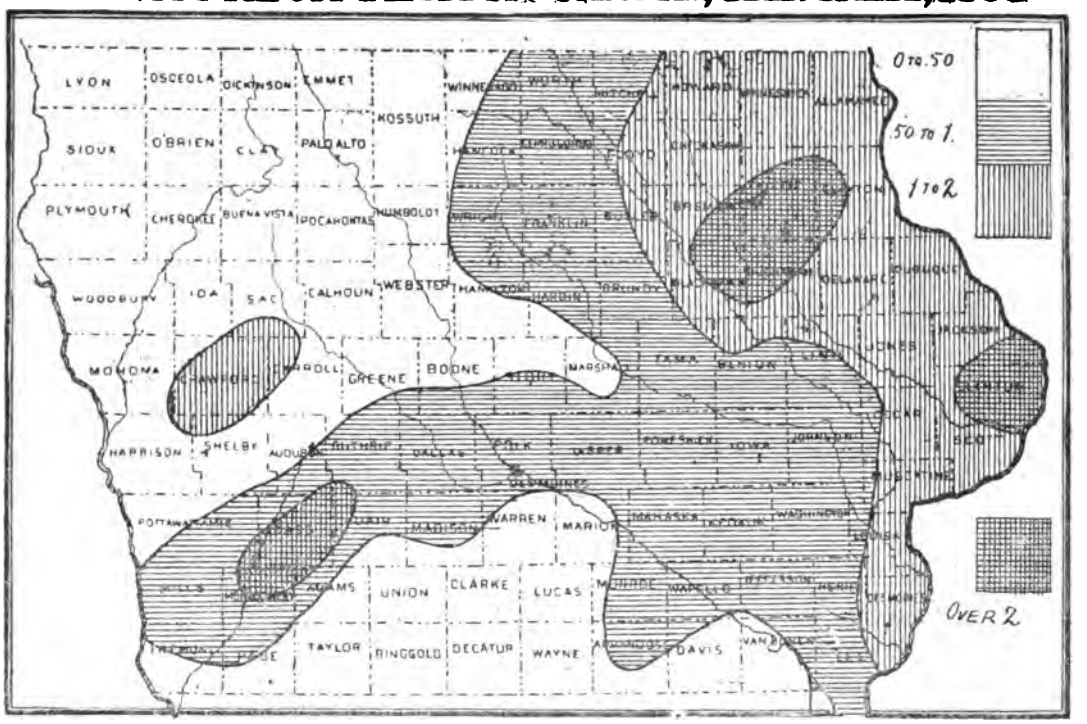
BY DAVID E. HADDEN.

Date.	CENTRAL TIME.	NUMBER VISIBLE		Faculæ.	Definition.	REMARKS.
		Groups.	Spots.			
1	3:00 P. M.	7	55	5	Fair...	Fac on N. E. limb. Two faculæ in by rotation. The large group is S. W. and has two spots with fine umbra and penumbra. All other groups small and E. of meridian.
2	11:45 A. M.	8	....	5	Fair...	New group on edge of N. E. limb by rotation.
5	11:30 A. M.	8	33	3	Good..	Group in facula disappearing by solar rotation.
7	11:30 A. M.	7	23	3	Good..	Faculæ region on S. E. limb. Very extensive region of facula W. All groups in N. latitude. Three groups are near W. and N. W. limbs.
9	11:25 A. M.	5	12	4	Good..	New spots on extreme edge of E. limb by rotation.
14	11:20 A. M.	2	8	2	Good..	Groups a little E. of meridian. Fac by rotation one day in E.
16	11:15 A. M.	4	21	3	Good..	New large group in facula just in on E. limb by rotation. Other small group is about two days in. Other two groups are near central meridian.
18	11:25 A. M.	6	30	2	Good..	New group E. of larger group one day in S. E. New small group on meridian in S. latitude. The large group is S. E. and very fine.
21	11:20 A. M.	7	62	5	Fair...	Haze. Fac by rotation. Group in facula about two days in N. E. Aurora this evening.
22	3:15 P. M.	4	106	4	Good..	Large group now on meridian S. latitude and has extensive penumbra area and numerous small spots.
23	11:45 A. M.	5	....	3	Poor ..	New group on extreme S. E. limb. Two groups of facula by rotation E. limb. Group small on sun's center.
26	11:45 A. M.	11	75?	3	Fair...	Two groups on edge E. and N. E. limbs by rotation. Two large groups are two or three days in. Two areas facula by rotation.
30	5:00 P. M.	6	40?	4	Poor ..	Fine large spot with large umbra in group S. latitude. Fac area near E. limb.

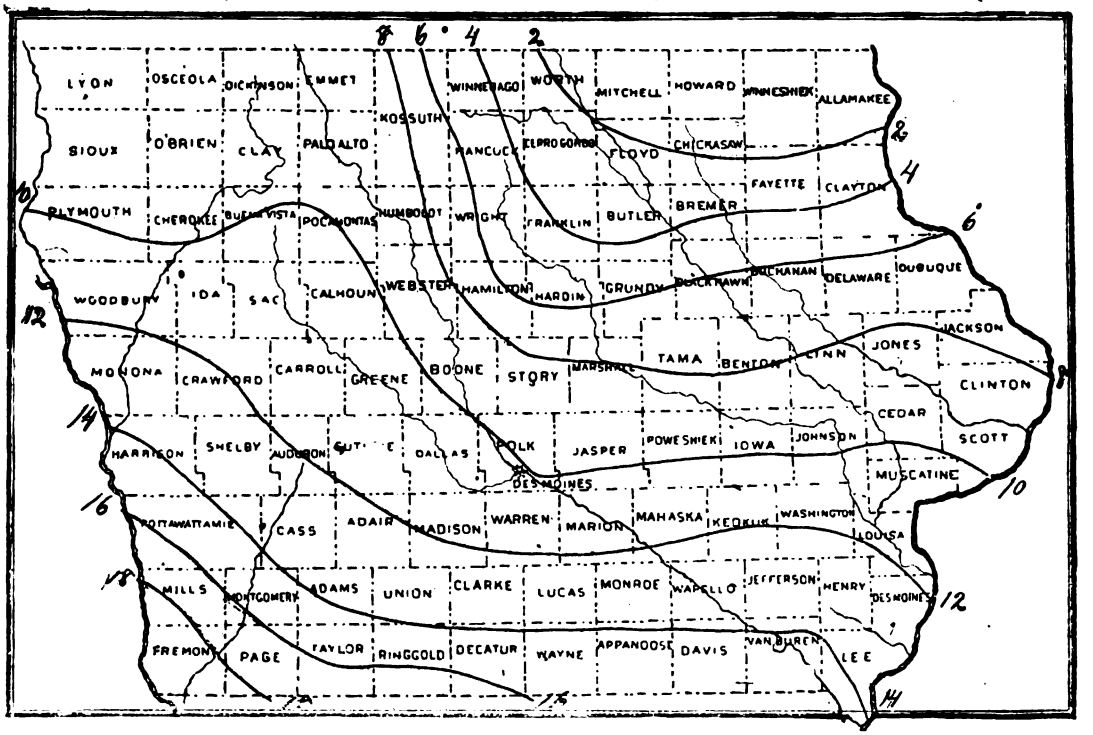
METEOROLOGICAL DATA FOR JANUARY, 1893.

STATIONS.	TEMPERATURE OF THE AIR (IN DEGREES FAHRENHEIT).								PRECIPITATION IN INCHES.								
	Monthly mean.	EXTREMES. Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Monthly range.	Monthly, including melted snow.	Total monthly snowfall.	Depth of unmelted snow at end of month.	Prevailing direction of wind.	No. of rainy days. (.01 inch or more).	No. of cloudy days.	No. of fair days.	No. of clear days.	No. of hail-storms.	No. of thunder-storms.
Audubon	11.0	40	24	22.3	-17	17	- 0.2	57	0.48	4.6	4.0	NW..	2	13	11	7	..	..
Ames (4 miles S. W. of)	10.1	....	....	....	....	....	....	....	0.26	2.6	2.6	....	8	....	....	....	..	..
Ames (F. C. Stewart, I. A. C.)	6.4	39	24	17.4	-21	17	- 5.3	60	0.28	....	8.0	NW..	6	8	14	9	..	..
Ames (E. N. Eaton, I. A. C.)	....	....	....	....	....	....	....	....	0.51	2.0	8.0	....	....	....	....	....	..	..
Algona	7.4	37	24	16.6	-18	27	- 1.9	55	0.26	2.5	1.0	NW..	7	14	7	10	..	..
Amana	7.5	39	24	16.5	-19	13, 17	- 1.5	58	0.55	4.9	6.0	NW..	6	10	9	12	..	..
Atlantic	12.8	44	4, 26	27.0	-21	13	- 1.5	65	0.28	2.8	6.0	NW..	4	13	9	9	..	..
Belle Plaine	6.7	39	24	15.9	-20	16, 13	- 2.4	59	0.90	9.0	12.0	NW..	7	6	11	14	..	..
Blakeville	6.1	....	....	....	....	....	....	....	0.20	22.0	22.0	NW..	10	10	9	12	..	..
Blockton	14.2	42	24	25.6	-15	15	2.8	57	....	....	6.0	3.0	....	....	....	....	..	..
Bonaparte	12.7	42	24	23.1	-14	17	2.3	56	0.60	2.0	2.0	NW..	4	....	....	....	..	..
Carroll	....	....	....	....	-15	13, 15	1.8	....	0.35	3.5	4.0	....	3	9	12	10	..	..
Cedar Falls	5.6	37	24	15.1	-20	13	- 3.8	67	1.40	14.0	8.0	NW..	5	10	5	16	..	..
Cedar Rapids	9.3	40	24	17.1	-15	17	1.4	55	0.72	7.5	10.0	NW..	10	15	7	9	..	..
Centerville	12.6	41	24	25.0	-18	10, 13	0.3	59	0.55	6.5	4.0	NW..	6	....	....	....	..	..
Charles City	2.3	31	24	11.6	-24	13	- 4.3	75	1.49	13.0	16.0	NW..	10	....	....	....	..	..
Clarinda	13.2	42	24	23.5	- 9	12,13,15,19	2.9	51	0.68	4.0	5.0	NW..	4	19	2	10	..	..
Clinton	8.3	39	24	19.4	-20	17	- 2.7	59	2.01	15.3	12.0	W....	10	6	18	7	..	..
College Springs	12.6	43	24	20.5	-13	15	4.7	56	0.20	2.0	6.0	NW N.	3	17	..	14	..	..
Corning	13.1	42	24	24.5	-14	13	1.7	56	0.25	2.5	10.0	NW..	3	16	11	10	..	..
Cresco	2.5	30	9, 20	12.4	-24	13	- 7.5	54	1.16	10.0	.....	NW..	10	13	8	10	..	..
Decorah	- 0.5	37	23	10.4	-36	14	-11.5	73	....	....	....	....	....	8	15	8	..	..
Davenport	9.2	39	24	16 6	-15	13	1.6	54	1.14	....	.....	W....	14	14	10	7	..	..
Delaware	1.6	....	....	....	....	....	....	....	0.86	10.4	17.0	NW..	9	11	10	10	..	..
Denison	14.5	41	24	26.4	-15	14	2.7	56	1.15	11.5	...	NW..	7	7	12	12	..	..
Des Moines	10.2	42	24	18.8	-14	13	1.7	56	0.56	7.4	6.4	NW..	10	11	18	12	..	..
Dubuque	20.3	32	8	14.5	-23	17	- 1.5	55	1.60	....	....	NW..	11	12	11	8	..	..
Eagle Grove	2.6	..	....	....	....	....	....	....	0.70	7.0	14.0	NW.	4	18	18	....	..	..
Eldora	5.5	37	24	15.4	-22	13	- 4.5	59	0.52	5.3	.....	.....	4	....	....	....	..	..
Emmetsburg	9.0	50	22	20.8	-13	13, 27	- 2.8	63	0.30	3.0	.....	.....	3	19	12	....	..	..
Estherville	12.6	40	24	22.4	-20	26	2.8	60	.....	12.0	8.0	.....	....	....	....	....	..	..
Fairfield	10.0	38	24	17.2	-13	13	2.9	51	1.16	4.7	3.0	SW...	6	17	....	14	..	..
Fayette	5.2	32	9	16.0	-24	17	5.2	56	1.05	12.2	19.0	NW..	10	11	7	13	..	..
Fort Madison	16.9	....	....	....	....	....	....	....	1.66	9.5	17.0	SW...	4	4	10	14	..	..
Grand Meadow	5.1	....	....	....	....	....	....	....	1.65	14.2	18.0	....	7	....	....	....	..	..
Galva	12.6	42	4	24.4	-15	13	0.8	57	0.20	2.0	4.0	NW.	4	5	5	21	..	..
Glenwood	18.2	54	4	30.6	- 9	27	5.6	63	0.73	5.2	3 0	NW..	3	7	17	7	..	..
Grinnell	8.7	33	9, 22, 24	17.8	-16	10, 13	- 0.4	49	0.12	1.2	.....	NW..	3	9	14	8	..	..
Greenfield	10.6	39	24	22.2	-17	13	0.9	56	0.45	5.5	12.0	NW..	7	20	5	6	..	..
Grundy Center	4.7	38	24	15.5	-18	12,18,31	- 6.1	56	0.50	4.3	15.0	NW..	8	6	15	10	..	..
Hampton	4.0	35	24	12.5	-19	13	- 4.5	54	0.82	7.0	15.0	NW..	5	14	2	15	..	..
Havelock	....	....	....	....	....	....	....	....	3.20	34.0	30 0	NW..	10	....	....	....	..	..
Hopkinton	10.1	....	....	....	....	....	....	....	1.20	12.0	15.0	NW..	7	....	....	....	..	..
Hopeville	11.8	40	24	22.2	-15	13, 15	1.5	55	0.17	1.5	6.0	NW..	3	3	20	8	..	..
Independence	6.6	38	24	17.2	-21	13	- 4.0	59	1.41	14.2	20.0	NW..	5	12	11	8	..	..
Indianola	10.9	41	24	20.2	-14	13	1.7	55	0.34	5.0	.....	NW.	3	4	17	10	..	..
Iowa City	10.2	42	24	20.8	-20	17	- 0.4	62	1.18	9.6	10.0	....	8	14	3	14	..	..
Iowa Falls	2.9	36	24	12.4	-21	13	- 6.6	57	0.52	4.0	10.0	NW..	5	12	6	13	..	..
Keokuk	14.3	45	24	23.5	-12	13	5.9	57	0.92	....	.....	NW..	10	10	16	5	..	..
Keosauqua	14.4	43	24	23.5	-10	13, 15	5.2	53	0.49	3.3	2.5	....	6	....	....	....	..	..
Larabee	9.0	39	22, 24	20.6	-19	13	- 2.7	58	0.13	1.8	1.2	NW..	6	18	5	8	..	..
La Crosse, Wis	5.9	32	8	14.1	-26	14	- 2.4	58	1.10	.....	.....	N....	12	15	9	7	..	..
Logan	14.8	40	4, 8	24.4	-12	19	5.4	52	0.40	4.0	.....	N....	3	18	2	11	..	..
Mt. Ayr	16.4	48	3, 23, 24	26.8	-12	13, 15	6.0	60	0.16	....	....	....	3	15	2	14	..	..
Marshalltown	10.1	38	24	19.4	-14	13	0.8	52	0.17	4.5	3.0	N....	4	6	1	24	..	..
Maquoketa	7.2	....	....	....	....	....	....	....	0.86	....	18.0	....	10	....	....	....	..	..
Mechanicsville	7.5	41	24	15.9	-16	13	0.9	57	1.44	14.3	40.5	NW..	16	15	8	8	..	..
Milton	....	....	....	....	....	....	....	....	0.40	4.0	.....	NW..	....	....	....	....	..	..
Mooar	7.0	34	2	15.8	-17	16	- 1.8	51	....	....	....	....	....	....	....	....	..	..
Monticello	5.6	40	24	14.0	-22	17	- 2.7	62	1.18	9.0	14.0	NW..	10	9	10	12	..	..
Mount Vernon	7.9	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	..	..
Murray	10.9	38	23	19 9	-13	13	1.8	51	0.23	2.3	2.0	N....	2	20	3	8	..	..
Maxon	9.1	....	....	....	....	....	....	....	0.25	2.5	.....	....	4	10	18	3	..	..
Omaha, Neb	15.9	47	22	24.3	- 9	27	7.5	56	0.28	....	....	NW..	7	6	13	12	..	..
Oskaloosa	10.5	40	24	20.9	-21	17	0.1	61	0.59	5.4	6.0	NW..	5	15	1	15	..	..
Osage	2.6	....	....	....	....	....	....	....	0.85	9.0	14.0	NW..	5	15	5	11	..	..
Panama	12.2	41	24	23.1	-13	15	1.4	54	0.29	2.9	2.0	NW..	3	11	15	5	..	..
Postville	9.0	40	24	19.4	-17	13, 17	1.3	57	0.67	9.8	7.0	N....	7	8	18	12	..	..
Richland	8.6	....	....	....	....	....	....	....	0.92	9.0	3.0	....	8	5	27	1	..	..
Sac City	7.8	38	22	14.9	-14	29	0.8	52	0.14	1.0	7.0	NW..	2	8	6	17	..	..
Sioux City	12.6	46	24	22.1	-11	26	3.1	57	0.34	....	.....	N....	7	12	9	10	..	..
Storm Lake	11.1	37	22	22.1	-16	27	0	53	0.17	1.8	3.0	NW..	9	10	11	10	..	..
Tipton	9.3	43	24	19.5	-18	13	-1.0	61	0.79	14.0	20 0	NW..	8	11	6	14	..	..
Villisca	15.0	44	5	29.4	- 9	19	6.6	53	0.20	0.2	.....	NW..	3	16	8	7	..	..
Vinton	6.6	....	....	....	....	....	....	....	0.86	10.0	7.0	NW..	6	7	13	11	..	..
Washington	11.9	40	24	19.4	-14	13	4.3	54	0.89	5.0	.....	NW..	5	....	....	....	..	..
Webster City	8.6	....	....	....	....	....	....	....	0.73	4.3	.....	NW..	6	4	15	12	..	..
Winterset	11.8	42	24	17.6	-16	13	3 6	58	0.52	5.2	7.0	....	4	12	9	10	..	..
Williams	5.1	....	....	....	....	....	....	....	0.33	2.6	6.0	NW..	6	8	9	14	..	..
Average for the State	9.3	54	4	19.6	-36	14	0.7	57	0.74	6.9	9.7	NW..	5.8	11.2	9.4	10.6	..	..

IOWA PRECIPITATION CHART, JANUARY, 1893



MEAN TEMPERATURE, JANUARY, 1893



MAXIMUM AND MINIMUM TEMPERATURE

STATIONS.	1		2		3		4		5		6		7		8		9		10		11		12		13		14		15	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Alta	32	12	9	0	15	- 1	35	26	7	- 1	22	-2	16	2	34	-1	10	8	7	-11	24	4	4	-10	10	-16	5	-15	7	-14
Amana	28	20	8	- 1	8	-10	17	7	29	2	15	-6	15	9	26	-5	34	0	1	-15	14	0	3	- 5	1	-19	2	-10	3	-14
Ames	30	8	26	1	7	-16	23	5	8	- 8	17	-8	18	2	32	-8	15	1	1	-18	14	*2	13	-10	4	-20	5	-13	6	-17
Atlantic	38	2	23	5	23	- 1	44	16	40	- 1	30	-6	36	2	37	-6	40	4	11	- 8	33	10	21	- 6	15	-21	12	-10	19	-14
Audubon	33	13	23	3	18	0	37	18	36	1	23	-2	30	5	35	0	36	3	9	- 9	24	8	20	- 5	7	-14	7	-11	7	-16
Belle Plaine	29	18	8	- 4	8	-10	17	8	31	1	14	-7	14	5	27	-7	15	-2	0	-20	15	5	5	- 6	3	-20	-3	-11	3	-15
Blockton	35	13	30	8	21	0	39	19	35	10	30	0	35	8	30	0	38	9	14	- 9	23	10	20	- 1	16	-13	12	- 7	10	-15
Bonaparte	31	20	28	2	13	- 5	26	13	33	2	17	-5	20	7	28	-1	35	3	9	-11	17	6	12	- 5	10	-13	9	- 9	9	-13
Cedar Falls	20	13	10	0	5	-14	29	5	10	2	20	-7	18	5	20	-5	15	10	0	-16	5	-6	2	- 6	-1	-20	-4	-15	7	-14
Cedar Rapids	33	21	10	0	12	- 8	35	5	9	2	18	-2	20	8	30	0	16	2	2	-10	12	4	6	- 2	0	-13	2	-10	5	- 9
Centerville	34	12	30	0	24	- 8	28	12	36	- 2	25	-11	28	-4	25	-7	36	4	8	-18	18	0	18	-10	10	-18	10	- 8	6	-15
Charles City	20	7	10	- 2	10	-12	16	- 2	5	0	10	-2	12	-4	20	-4	11	-4	0	-21	12	0	1	-15	-4	-24	-8	-18	-2	-12
Clarinda	38	11	26	4	22	7	41	23	34	6	32	-3	30	8	36	3	36	2	14	- 4	25	12	11	- 9	12	- 9	10	- 8	13	- 9
Clinton	28	19	23	- 4	10	-18	23	8	21	- 2	14	-10	21	2	24	-8	32	1	1	-16	11	-3	8	- 4	1	-17	2	-12	2	-15
College Springs	35	7	27	5	25	1	32	20	23	2	12	-8	31	1	14	12	12	2	16	- 6	27	10	12	0	10	-12	8	4	9	-13
Corning	38	8	25	5	22	0	41	19	35	7	24	-2	33	7	32	-2	37	6	10	- 8	26	8	26	- 2	8	-14	8	- 8	11	-12
Cresco	26	16	5	-10	3	-20	13	0	20	- 4	10	-10	15	-2	27	-9	30	-10	-2	-23	9	-5	-1	-12	-5	-24	-11	-19	-2	-17
Davenport	25	22	10	1	7	-12	19	7	25	3	14	-4	18	11	22	-1	33	5	-1	-12	11	-1	3	- 3	-1	-15	2	- 9	3	-12
Decorah	32	8	11	-19	4	-23	7	-17	- 6	-20	- 5	-15	- 6	-23	7	-25	-8	-27	-9	-12	-2	-7	-3	-17	-7	-33	-3	-36	-4	-24
Denison	35	10	15	3	24	4	40	20	37	4	33	2	32	4	38	2	39	-1	16	- 8	28	8	14	6	11	- 8	11	-15	8	- 2
Des Moines	32	12	18	6	12	- 3	29	12	10	3	19	-4	28	7	32	-1	15	6	3	-10	19	2	7	3	6	-14	8	-10	7	-11
Dubuque	27	20	10	4	2	-12	20	1	8	4	10	-5	20	8	32	-7	20	3	0	-12	6	-5	5	2	-2	-16	-2	-12	3	-15
Eldora	20	..	6	6	11	-13	32	- 6	5	0	14	-8	25	0	30	-7	10	6	6	-20	13	-2	2	-11	3	-22	-8	-10	5	-16
Emmetsburg	24	15	16	- 5	21	- 5	28	7	28	- 3	24	-6	37	1	18	-4	16	-9	5	-11	23	9	22	7	7	-17	5	-15	23	-14
Estherville	30	0	30	- 4	30	- 9	35	30	35	- 1	25	15	25	15	30	15	35	-3	20	0	15	0	10	-10	10	-10	10	-15	10	-10
Fairfield	..	..	10	0	17	- 2	23	10	7	2	17	-3	16	8	28	0	14	0	7	-11	16	7	6	- 7	7	-13	1	-10	7	-10
Fayette	27	17	23	- 8	3	-16	14	3	13	2	14	-7	14	3	30	-9	32	-4	0	-18	11	-3	5	- 6	5	-20	-7	-14	5	-15
Galva	33	8	20	0	19	4	42	14	35	2	32	-1	31	4	35	0	35	4	31	- 9	28	9	17	- 5	15	-15	10	- 7	13	- 7
Glenwood	42	11	28	8	26	4	54	25	40	10	39	4	38	10	40	5	42	8	10	- 3	36	10	25	- 2	18	- 8	4	- 6	18	- 8
Greenfield	33	12	15	2	19	- 3	38	17	33	- 2	24	-5	30	2	30	-2	30	-4	12	-12	22	8	18	- 7	11	-17	11	-14	8	-15
Grinnell	28	16	24	0	7	- 9	19	7	31	- 2	15	-2	16	3	25	-2	33	-1	0	-16	12	2	12	- 8	1	-16	4	- 9	4	-13
Grundy Center	29	4	4	-12	9	- 6	31	0	7	- 7	14	0	15	-4	33	-4	10	-17	5	-17	15	-10	2	-18	4	-18	7	-14	4	-12
Hampton	27	9	3	-10	5	-13	22	5	6	- 2	13	0	14	-1	32	-5	8	-9	0	-18	13	-3	10	-11	-1	-19	-9	-14	4	-15
Hopeville	33	14	22	2	17	1	35	15	30	4	23	-4	30	4	32	-2	36	2	8	-11	22	8	19	- 5	9	-15	7	-11	8	-15
Independence	26	17	27	0	4	-17	15	- 1	27	1	12	-8	15	2	21	-7	34	4	8	-17	1	-6	7	- 6	1	-21	-1	-11	2	-16
Indianola	30	13	30	5	12	- 4	28	11	11	2	19	11	20	7	27	-7	11	....	14	-12	18	2	6	5	8	-14	7	- 4	8	-12
Iowa City	29	20	27	3	5	-10	24	4	29	4	13	-5	22	12	20	-6	34	6	5	-13	15	-2	10	- 3	3	-17	7	- 8	5	-14
Iowa Falls	27	10	3	-10	4	-14	23	4	5	- 4	15	-9	12	-2	31	-7	8	-11	-2	-20	13	-3	0	-14	1	-21	-10	-15	4	-17
Keokuk	33	25	33	5	14	- 2	24	13	12	7	25	-2	20	13	35	1	23	10	7	- 9	15	5	7	1	11	-12	7	- 6	9	-11
Keosauqua	53	21	29	5	12	0	24	12	33	7	15	0	20	13	23	2	23	11	11	- 8	17	0	14	0	7	-10	9	- 5	10	-10
Logan	35	9	30	8	26	6	40	20	30	10	36	6	20	8	40	8	30	10	15	- 5	34	15	10	5	20	-10	4	- 5	15	-10
Larrabee	33	12	11	- 6	18	- 3	37	14	15	- 3	31	-2	26	0	36	-2	35	-4	7	-11	27	6	10	- 9	10	-19	9	-17	9	-14
La Crosse, Wis	26	16	13	2	6	-13	22	2	6	1	12	-7	19	1	32	-6	14	2	-2	-16	9	-7	7	- 1	-4	-17	-10	-26	4	-13
Mt. Ayr	38	15	36	3	20	5	48	19	39	3	25	1	36	6	33	-1	39	4	20	- 9	31	10	22	- 4	17	-12	9	-10	10	-12
Mooar	32	12	34	15	31	6	26	5	15	- 8	14	1	23	-2	11	0	18	-2	7	- 2	8	3	14	- 2	10	-16	8	-14	11	- 8
Marshalltown	31	15	30	4	7	- 6	32	1	32	2	15	-3	17	4	16	-2	14	7	11	-13	15	-3	20	- 6	5	-14	5	- 5	-1	-11
Mechanicsville	27	21	8	0	11	-13	26	4	7	- 3	13	-8	18	10	24	-4	17	-2	-1	-15	11	-1	3	- 3	1	-16	3	-10	4	-14
Murray	32	15	18	16	29	1	36	11	22	3	20	-4	16	7	36	0	12	5	12	-10	22	7	9	- 4	10	-13	5	-10	8	-12
Newton	33	14	30	3	5	- 7	23	5	13	1	15	-6	17	4	24	-4	35	6	6	-15	15	-1	15	- 8	4	-17	4	-10	4	-16
Omaha, Neb	38	15	23	10	24	5	41	24	18	11	41	10	21	10	43	10	24	12	11	0	35	11	15	1	13	- 5	8	- 3	14	- 5
Oskaloosa	30	17	25	0	12	- 6	24	12	18	4	17	-7	17	6	30	-3	35	0	5	-14	16	3	14	- 5	6	-17	6	-10	7	-17
Panama	32	6	22	4	20	3	38	20	37	6	29	3	34	6	39	2	39	5	9	- 8	26	9	18	- 3	9	- 4	9	-10	9	-13
Sac City	25	16	10	3	15	3	32	19	10	1	24	9	12	4	28	14	11	0	5	-10	8	-2	3	- 6	-6	-18	-8	-10	7	-12
Sioux City	35	17	14	6	22	4	41	18	15	5	40	5	20	8	48	8	18	8	9	- 4	32	8	16	- 2	15	- 9	2	-11	12	-11
Storm Lake	31	14	29	4	15	- 1	34	13	36	0	23	-1	20	3	32	1	35	1	6	-10	24	4	24	- 5	10	-14	8	- 9	7	-12
Tipton	28	20	24	- 4	9	-15	21	9	25	0	13	-7	18	8	23	-4	32	-2	4	-15	12	-2	6	- 4	2	-18	1	-12	4	-14
Villisca	42	16	40	22	38	9	40	18	44	29	31	5	36	18	25	16	33	-2	....	...	23	1	29	10	26	- 7	17	- 3	21	- 7
Winterset	33	14	14	3	14	3	35	17	11	4	18	-5	11	6	27	-2	13	8	10	1	20	10	10	- 5	7	-16	10	- 1	5	-14
Washington	31	23	15	3	14	- 5	21	14	10	4	18	-2	16	12	25	-2	18	2	10	-12	17	6	12	- 4	8	-14	6	- 8	12	-11

FOR JANUARY, 1893.

16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		Monthly Mean.	
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
4	- 8	26	-10	10	- 8	22	- 2	27	18	32	18	37	16	30	12	37	10	22	0	- 4	-16	3	-18	10	- 4	5	-15	9	- 4	20	-13	16.6	- 1.9
6	- 4	20	-19	7	- 1	16	-13	31	-12	29	25	35	10	20	10	39	6	26	16	- 2	- 8	9	- 9	17	8	7	- 8	14	3	33	- 3	16.5	- 1.5
8	- 2	19	-21	20	- 6	18	-19	29	17	35	19	36	2	29	14	38	12	24	- 4	16	-15	2	-15	11	2	11	-13	14	- 2	29	- 8	17.4	- 4.6
17	-17	26	-20	27	- 8	27	-17	41	20	28	12	44	2	33	24	34	23	27	9	19	- 8	5	-11	14	- 7	13	-10	19	1	40	- 4	27.0	- 1.5
8	-12	23	-17	22	- 6	18	-12	32	18	28	13	38	13	30	17	40	20	23	5	15	-11	3	-14	11	1	8	-11	14	1	33	- 6	22.3	- 0.2
7	-10	24	-18	7	- 3	18	-12	32	12	29	20	35	4	30	9	36	7	27	11	- 3	-10	7	-11	15	5	6	-10	13	- 2	32	- 3	15.9	- 2.4
13	3	32	15	22	- 3	20	-13	35	0	33	11	38	6	29	8	42	21	32	19	25	6	6	- 5	12	-15	10	- 8	15	8	43	3	25.6	2.8
13	- 4	32	-14	22	- 3	22	-10	36	15	35	24	39	19	30	17	42	14	32	12	8	0	13	- 4	25	10	17	- 4	18	6	35	3	23.1	2.3
7	-10	17	-19	15	- 7	10	-16	22	-14	29	20	33	6	23	10	37	20	20	6	25	-10	16	-15	14	- 5	15	-10	10	- 2	20	- 5	15.1	- 3.8
7	- 7	20	-15	6	0	19	- 7	32	13	30	18	34	12	26	14	40	10	29	18	3	- 5	9	- 7	20	8	8	- 4	16	4	34	4	17.2	1.4
11	0	33	-10	26	- 2	25	- 8	36	14	31	21	36	24	33	19	41	17	30	10	32	- 6	10	- 6	22	6	17	- 7	16	6	38	4	25.0	0.3
-10	-18	10	-10	0	-10	18	-20	30	20	30	20	30	4	24	5	31	20	22	12	- 7	-18	6	-10	14	4	5	-14	4	-12	20	- 8	11.6	- 4.3
13	- 4	27	- 5	11	- 2	23	- 9	39	17	29	14	39	9	31	25	42	33	24	8	- 1	- 8	5	- 8	10	1	10	- 8	14	6	38	- 8	23.5	2.9
9	-11	20	-20	20	- 4	16	-15	27	9	30	20	30	12	23	- 2	39	4	26	- 2	10	- 5	15	- 5	29	16	27	- 5	23	4	36	0	19.4	- 2.7
13	6	25	- 5	9	- 3	21	- 5	35	16	29	10	37	11	30	25	43	23	28	20	0	- 7	8	- 6	13	4	1	- 9	20	3	41	21	20.5	4.7
13	- 2	24	-11	21	- 2	22	-10	40	17	27	12	39	6	33	23	42	22	25	12	17	- 9	3	- 9	12	1	11	- 9	17	4	38	- 2	24.5	1.7
0	-16	15	-21	5	- 8	15	-15	30	11	27	12	29	5	17	1	24	1	25	10	- 7	-15	3	-18	22	7	7	-15	12	- 8	22	-13	12.4	- 7.5
7	- 2	22	-11	6	2	15	- 7	27	8	28	22	30	19	23	11	39	8	25	9	3	- 3	12	- 5	27	12	9	- 4	18	6	34	4	16.6	1.6
8	-22	10	-14	12	-17	23	-12	32	6	30	7	34	10	17	14	21	13	25	- 7	2	-15	14	- 8	22	-10	19	0	16	- 3	10	- 7	10.4	-11.5
10	- 6	30	- 7	25	6	34	- 7	29	21	32	18	41	22	34	20	41	32	32	8	23	-11	21	-14	18	2	20	-11	17	1	30	-10	26.4	2.7
11	1	22	-13	9	0	21	-10	33	18	26	21	40	11	26	20	42	19	26	8	1	- 8	7	- 8	14	5	7	- 8	18	3	34	2	18.8	1.7
5	- 7	17	-23	8	0	16	-12	23	10	29	20	26	8	22	3	25	8	23	8	3	- 4	11	-11	22	10	10	- 5	20	1	32	- 4	14.5	- 1.5
9	- 8	21	-16	12	- 6	20	-13	30	12	37	21	...	...	32	12	37	10	26	8	20	-15	3	-16	13	4	13	-14	12	- 2	28	- 5	15 4	- 4.5
22	- 6	16	-10	4	- 8	25	- 7	39	20	39	20	50	19	40	10	33	7	29	- 2	10	-16	5	-17	14	- 1	8	-16	8	- 6	15	-14	20.8	- 2.8
10	-10	10	0	20	10	25	10	25	20	25	20	35	20	25	20	40	20	30	10	30	-20	20	-10	20	- 5	10	- 5	10	- 5	10	0	22.4	2.8
8	2	...	...	8	0	11	0	31	12	29	17	34	17	37	16	38	17	28	11	1	- 4	10	- 5	19	9	...	...	17	8	32	10	17.2	2.9
5	-12	15	-24	16	- 5	16	-20	29	12	26	15	29	- 1	18	2	28	- 2	25	14	20	-12	7	-17	19	7	14	-11	14	-10	27	-10	16.0	- 5.5
9	- 7	29	-11	25	- 6	27	- 8	30	21	34	17	38	15	35	15	38	27	30	5	5	-13	10	-14	13	2	10	- 8	13	- 3	25	- 9	24.4	0.8
...	...	35	- 1	28	0	32	- 4	54	22	39	16	48	20	42	28	46	26	28	16	20	- 6	4	- 9	10	- 2	11	- 6	18	6	44	- 6	30.6	5.6
12	-10	21	-11	21	- 6	22	- 8	33	16	27	12	36	16	33	17	39	20	24	5	9	-11	6	-13	8	3	10	-12	12	- 1	37	- 6	22.2	- 0.9
5	- 3	22	- 8	17	- 3	15	- 4	26	13	26	22	33	13	24	13	33	16	23	9	20	-12	5	-11	14	4	12	-10	12	0	32	0	17.8	- 0.4
4	-14	20	- 8	10	- 5	22	-11	30	22	28	10	34	12	30	11	38	19	26	-13	- 6	-15	4	-11	14	-11	8	-11	12	- 2	30	-17	15.5	- 6.1
0	-12	18	-16	6	- 6	16	-10	27	4	28	20	32	12	17	8	35	11	21	2	- 7	-15	2	-16	14	0	4	-13	11	- 3	25	-10	12.5	- 4.5
9	- 3	24	- 9	21	- 3	21	- 5	35	18	25	19	37	9	30	20	40	20	27	12	17	- 9	4	- 8	8	4	9	- 8	14	4	36	- 2	22.2	1.5
4	- 6	16	-20	19	- 6	14	-15	29	8	28	23	29	3	27	6	38	4	25	14	24	-11	6	-16	17	3	17	-12	13	- 3	30	- 9	17.2	- 4.0
10	- 6	23	-11	22	- 1	23	- 6	32	15	28	19	37	10	32	15	41	16	26	3	...	- 9	4	-11	13	2	15	- 3	16	2	25	1	20.2	1.7
11	- 2	33	-20	22	- 1	16	-11	31	8	28	24	34	7	34	12	42	4	28	7	25	- 6	10	- 8	21	6	20	- 7	19	4	33	- 1	20.8	- 0.4
-2	-15	18	-20	7	- 8	18	-16	27	16	28	16	34	6	20	9	36	10	21	2	- 7	-18	0	-19	13	0	0	-16	10	-6	26	-12	12.4	- 6.6
14	3	36	- 6	13	6	20	- 5	34	13	31	25	40	21	34	20	34	19	34	17	6	0	16	- 1	28	15	13	- 1	21	11	38	8	23.5	3.9
17	4	32	- 9	29	5	23	- 8	35	14	32	25	39	20	35	19	43	17	36	14	24	0	9	- 2	22	10	19	- 1	20	9	34	5	23.5	5.2
12	0	27	-10	30	3	29	-12	34	22	35	18	35	20	25	23	37	27	29	18	0	- 7	6	-10	11	-4	10	- 7	18	7	26	- 4	24.4	5.4
8	- 9	27	-10	9	- 9	29	- 6	28	19	34	18	30	15	34	11	39	11	20	2	2	-15	4	-17	14	-2	8	-15	10	-6	19	-13	20.6	- 2.7
6	-10	16	-20	9	- 2	18	-12	26	13	30	20	30	11	25	6	25	13	24	13	- 2	-10	8	-18	19	5	9	- 4	12	-2	28	6	14.1	- 2.4
22	- 2	30	- 6	25	0	22	- 2	46	18	31	18	40	14	48	22	48	22	33	16	22	- 8	7	- 7	15	5	15	-11	31	6	39	- 3	26.8	6.0
6	-17	30	-11	11	-11	2	-11	16	4	11	- 2	9	- 2	16	2	16	0	21	3	15	0	17	2	10	- 3	18	4	17	1	13	0	15.8	- 1.8
8	- 1	21	- 9	20	- 1	15	- 7	30	15	30	21	34	15	35	20	38	25	36	11	25	-10	0	-10	12	0	14	- 8	14	-6	30	1	19.4	0.8
7	- 4	18	-14	8	- 1	18	- 7	31	7	32	24	32	10	21	9	41	6	27	10	2	- 6	9	- 9	22	6	9	- 8	18	6	32	- 2	15.9	- 0.9
8	0	10	- 8	24	- 2	24	- 3	33	17	24	19	32	11	38	21	27	11	0	-8	7	- 9	12	3	6	-8	20	- 8	20	4	36	3	19.9	1.8
6	- 1	23	-17	20	- 4	18	- 9	32	16	27	21	36	10	33	10	40	12	26	4	27	-11	4	-11	13	3	13	-10	13	0	31	- 1	19.5	- 1.3
11	7	30	2	16	0	28	4	37	26	36	16	47	25	36	26	43	28	23	16	2	- 5	5	- 9	22	2	8	- 5	15	-4	36	- 2	24 3	7.5
9	- 6	30	-21	17	0	22	-15	36	18	30	23	39	14	27	13	40	12	28	14	21	- 6	8	- 8	15	7	14	- 7	17	3	34	- 1	20.9	0.1
9	- 7	25	-10	25	- 5	23	- 8	29	5	24	16	38	9	35	19	41	23	23	11	14	- 9	2	-13	10	1	7	- 9	12	3	30	- 8	33.1	1.4
4	-10	23	3	7	- 7	25	- 6	28	22	37	21	38	20	31	15	37	15	14	-1	1	-14	3	-13	10	-3	6	-14	9	0	22	-10	14.9	0.8
9	- 2	30	- 4	16	- 6	33	0	27	21	34	13	40	16	36	22	46	22	20	11	0	-11	6	-11	11	2	11	-10	13	-7	22	-10	22.1	3.1
8	- 5	26	- 9	25	- 7	29	0	26	20	32	18	37	28	34	14	37	21	23	6	12	-14	1	-16	12	-1	11	-13	11	-13	18	- 6	22.1	0.0
9	- 5	21	-14	21	- 1	18	- 9	30	12	33	23	32	13	26	8	43	8	27	6	19	- 8	10	- 8	22	10	15	- 7	21	5	34	- 2	19.5	- 1.0
19	- 5	29	- 6	21	7	21	- 9	28	-1	37	18	35	12	38	24	40	28	41	16	31	3	16	- 6	15	-5	18	0	20	4	26	4	29.4	6.6
10	1	24	-12	11	- 3	23	- 8	35	17	25	18	38	12	29	20	42	33	27	7	1	-10	4	-11	11	5	14	-10	18	2	38	2	17.6	3.6
12	1	30	-12	10	4	14	- 6	34	22	38	24	38	20	30	14	40	20	30	14	4	- 4	10	0	19	12	14	- 6	22	9	30	16	19.4	4.3

DAILY AND MONTHLY MEAN TEMPERATURE FOR JANUARY, 1893.

STATIONS.	DATE.																													Monthly mean.
	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	31st.	
Ames—4 mi. S W of	22	6	4	24	4	10	10	18	8	-2	12	0	0	-2	2	0	11	3	12	24	23	28	18	26	16	-2	-2	10	-2	10	18	10.1
Algona	26	6	7	20	4	14	6	20	4	6	9	5	6	9	8	2	13	7	15	19	23	26	17	18	9	12	-7	5	-2	4	12	...
Alta	22	4	7	30	3	10	9	17	1	-2	14	-4	-3	-10	-4	3	8	1	10	23	25	26	21	24	11	-6	-7	5	5	2	3	7.5
Ames (F. C. Stewart)	19	14	-4	14	0	4	10	7	8	-8	6	2	-8	-4	-6	1	3	1	7	0	23	22	19	22	10	0	-6	6	-1	6	10	6.4
Amana	24	4	-1	12	16	4	12	10	17	-7	7	-1	-9	-4	-6	1	0	3	2	10	20	23	15	28	21	-5	0	12	0	8	15	7.5
Atlantic	20	14	11	30	20	12	19	16	22	2	22	8	-3	1	-2	-2	3	2	3	5	30	20	28	28	18	6	-5	4	2	10	18	12.8
Audubon	23	13	9	28	18	12	18	18	18	0	16	8	-4	-2	-6	-2	3	8	3	25	24	20	26	24	14	2	-6	6	-2	8	14	11.0
Belle Plaine	24	2	-1	12	16	4	10	10	6	-10	10	0	-8	-7	-6	-2	3	3	3	22	24	20	14	23	19	-6	-2	10	-2	6	14	6.7
Blakeville	24	5	-1	10	2	8	10	18	-6	-1	3	-5	-5	-9	-6	-5	-7	2	4	26	24	19	13	18	20	-9	-2	8	-2	6	4	6.1
Blockton	24	19	10	29	22	15	22	15	24	2	16	10	-2	-2	-2	8	24	10	4	18	22	22	18	22	26	16	0	-2	1	12	23	14.2
Bonaparte	26	15	4	20	18	6	14	14	19	-1	12	4	-2	0	-4	4	9	10	6	26	30	29	24	28	22	4	4	18	6	12	19	12.7
Cedar Falls	16	5	-4	17	6	6	12	8	12	-8	0	-2	-10	-10	-4	-2	-1	4	-3	4	24	20	16	28	13	8	0	4	2	4	8	5.6
Cedar Rapids	27	5	2	15	6	8	14	15	9	-4	8	2	-6	-4	-2	0	6	3	6	22	24	23	20	25	24	-1	1	14	10	19	19	9.3
Centerville	23	15	8	20	17	7	12	9	20	-5	9	4	-8	1	-4	6	12	12	9	25	25	30	26	28	20	13	2	14	5	11	21	12.6
Charles City	14	4	-1	7	2	4	4	8	4	-10	6	-7	-10	-5	-5	2	0	-5	-1	25	25	17	14	26	17	-6	-2	9	-4	-4	14	2.3
Clarinda	24	12	14	32	20	18	19	20	19	5	18	1	2	1	-2	4	11	4	7	28	24	24	28	26	16	4	2	8	2	6	14	13.
Clinton	24	10	-4	16	10	4	12	8	16	-8	4	2	-8	-5	-6	-1	0	8	0	18	25	16	10	32	12	2	5	22	11	4	18	8.3
College Springs	21	16	13	21	12	10	16	13	7	5	18	6	-1	6	-2	10	10	3	8	26	20	24	28	32	18	4	-5	6	1	10	18	12.6
Corning	23	16	11	30	21	11	20	15	22	1	17	2	-3	0	-1	6	6	10	6	28	20	22	28	32	18	4	-3	6	1	10	18	13.1
Cresco	21	-4	-4	6	8	0	4	9	10	-12	2	-6	-14	-15	-10	-8	-3	-2	0	20	20	17	9	12	18	-11	-8	14	-4	2	4	2.5
Decorah	20	-4	-10	-5	-13	-10	-14	-9	-18	-10	-4	-10	-22	-20	-14	-7	-2	-2	-4	6	19	18	22	26	17	9	-6	3	6	10	6	2	-0.5
Davenport	24	6	-2	13	14	5	14	10	19	-6	5	0	-8	-4	-4	6	4	4	4	18	22	24	17	24	17	0	4	20	2	12	19	9.2
Delaware	22	3	-10	6	0	1	5	5	6	-14	-1	-2	-15	-12	-14	-7	-4	-4	-4	18	22	14	4	17	16	-10	-1	14	-8	-6	8	1.6
Denison	22	9	14	30	20	18	18	20	19	4	18	10	-2	-1	-2	3	12	16	14	25	25	32	27	32	20	6	4	10	4	9	10	14.5
Des Moines	23	12	4	20	6	8	18	16	10	4	10	2	-4	-1	-2	6	4	4	6	26	24	26	23	30	17	-4	0	10	0	10	18	10.2
Dubuque	24	7	-5	10	6	2	14	12	12	-6	0	4	-9	-7	-6	-1	-3	4	2	16	24	17	12	16	6	0	0	16	2	10	14	6.5
Eagle Grove	11	0	-6	16	-2	9	4	11	0	-8	4	-8	-10	-12	-6	-4	4	-5	3	24	20	14	14	23	6	-15	-6	4	-7	3	5	2.6
Eldora	..	6	-1	13	2	3	12	12	3	-7	6	4	-10	-9	-6	-4	3	3	4	21	24	..	22	24	17	2	-6	8	0	5	12	5.5
Emmetsburg	20	6	8	18	12	9	19	7	4	-3	12	14	-5	-5	-4	8	3	-2	9	30	30	34	25	30	9	-3	-6	6	-4	1	0	9.0
Estherville	15	13	10	25	17	20	20	22	16	10	8	0	0	-2	0	0	5	15	18	22	22	26	20	28	20	5	5	8	2	5	5	12.6
Fairfield	...	6	8	16	4	7	12	14	7	-2	12	0	3	-4	-2	5	...	4	6	22	20	26	26	28	20	2	5	14	...	12	21	10.0
Fayette	22	8	-6	8	8	4	8	10	14	-9	4	0	-8	10	-5	-4	-4	6	2	20	20	14	10	13	6	-10	-4	13	2	2	8	5.2
Fort Madison	28	16	9	22	12	11	18	19	16	8	14	8	8	8	4	10	20	12	10	22	30	28	24	28	28	7	12	24	12	18	30	16.9
Grand Meadow	24	0	-2	8	0	5	6	12	-8	-2	-4	-11	-14	-5	-6	6	6	3	8	22	20	20	13	26	20	-10	3	15	-1	2	6	5.1
Galva	16	10	12	28	18	16	18	18	20	11	18	12	6	0	-2	3	1	9	10	26	26	26	25	32	18	-4	-2	8	1	5	8	12.6
Glenwood	26	18	15	40	25	22	24	22	25	11	23	12	5	-1	-5	5	...	17	14	14	28	34	35	36	22	-7	2	4	1	6	12	18.2
Grinnell	22	12	-1	13	14	6	10	12	16	-8	7	2	-8	-2	-4	1	7	7	6	21	24	23	18	24	16	4	-3	9	1	6	16	8.7
Greenfield	33	8	11	27	16	9	16	14	13	0	15	5	-3	-2	-4	1	5	7	7	25	20	26	25	30	14	-1	-4	6	1	6	16	10.6
Grundy Center	16	-4	2	16	0	7	6	14	-4	-6	2	-8	-7	-10	-4	-5	6	2	6	26	19	23	20	24	6	-10	-4	12	2	5	6	4.7
Hampton	18	-4	-4	12	9	6	6	14	0	-9	5	-6	-10	-12	-6	-6	1	3	0	30	28	24	22	12	23	12	-11	-7	7	4	8	4.0
H pkinton	26	6	2	12	5	9	12	10	12	-3	6	2	-6	-6	-2	6	3	10	26	28	19	16	24	30	23	0	4	19	0	9	15	28	10.1
Hopeville	24	12	9	25	17	10	17	15	19	-2	15	7	-3	-2	-4	3	8	9	8	26	22	23	25	30	20	4	-2	6	0	9	17	11.8
Independence	32	14	-6	7	14	2	8	7	19	-4	-2	0	-10	-3	-2	-1	-2	6	10	28	26	16	16	24	19	6	-5	10	2	5	10	6 6
Indianola	32	18	4	19	6	15	14	10	..	1	10	6	-3	-2	-2	2	6	10	8	21	24	24	23	28	15	..	-3	7	5	9	13	10.9
Iowa City	24	15	2	14	16	4	17	7	20	-4	6	4	-7	0	-4	4	2	10	8	21	26	20	24	33	18	9	1	14	6	12	16	10.2
Iowa Falls	18	-4	-5	14	0	3	5	12	-2	-11	6	-7	-10	-12	-6	-6	-1	0	1	22	32	24	23	34	12	-12	-10	6	-8	2	7	2.9
Keokuk	29	19	6	18	10	12	16	18	16	-1	10	4	0	0	-1	-8	15	10	8	24	28	30	27	32	26	3	8	22	6	16	23	14.3
Keosauqua	27	17	6	18	20	8	16	12	17	2	8	2	-2	-2	-2	0	12	17	8	24	28	30	27	30	25	12	4	16	9	14	20	14.4
Larrabee	21	2	8	26	6	14	13	17	16	-2	16	1	-4	-4	-2	0	8	0	12	24	26	27	22	25	11	-6	-6	6	-2	2	3	9.0
La Crosse, Wis	21	8	-4	12	4	2	10	13	8	-9	1	3	-10	-18	-4	11	-3	4	3	20	25	20	16	19	18	-6	-5	12	-2	5	17	5.9
Logan	12	19	16	30	20	21	14	24	20	5	24	8	5	0	0	1	8	5	11	28	28	28	24	28	23	-4	-2	8	-2	4	12	11.8
Mt. Ayr	26	20	12	34	21	13	21	16	22	6	26	9	2	-1	-6	10	12	12	10	32	26	24	27	35	24	17	0	10	2	3	18	16.4
Marshalltown	33	17	0	12	17	6	10	7	10	-1	6	7	-4	-2	-5	6	10	6	4	22	26	24	24	32	24	8	-5	6	2	4	16	10.1
Maquoketa	24	4	2	12	2	8	12	14	7	-4	4	-2	-7	-4	-5	-2	6	4	2	6	20	26	16	15	18	15	-3	10	7	4	8	12	7.2
Mechanicsville	24	4	-1	12	2	2	14	10	8	-2	5	0	-8	-4	-4	2	4	6	4	19	28	21	15	24	18	-2	0	14	0	12	15	7.5
Mooar	22	24	18	16	4	8	10	6	8	-2	6	6	-3	-3	-2	-6	10	0	-4	10	4	9	8	12	8	10	4	11	3	6	7	7.0
Monticello	24	0	-2	10	2	8	6	7	8	-8	4	-2	-11	-9	-6	-4	6	0	4	23	25	15	9	22	18	-8	4	16	-2	6	10	5.7
Mt. Vernon	23	3	2	14	1	9	9	16	1	-5	8	4	-7	-2	-6	-2	1	5	9	27	25	20	13	25	23	-8	7	14	0	8	9	7.9
Murray	24	17	15	24	12	13	12	18	8	1	14	2	-2	-2	-2	2	4	1	11	12	22	21	25	30	19	-4	-1	8	-1	6	12	20	10.9
Maxon	23	-4	8	18	0	13	7	19	-3	4	10	-8	4	2	-1	1	11	2	3	24	24	23	22	26	15	6	-4	8	2	6	15	9.1
Newton	24	16	-1	14	7	4	10	10	20	-8	7	8	4	-6	-3	4	11	2	8	4	24	24	23	22	26	15	6	-4	8	2	6	15	9.0
Omaha, Neb	26	16	14	32	14	26	16	26	18	6	23	8	4	2	-2	4	16	8	4	24	26	26	26	31	26	20	-2	7	4	6	17	15.9
Oskaloosa	24	12	3	18	11	5	12	14	18	-4	10	4	-6	-2	-5	2	9	16	8	4	27	26	26	36	20	-2	-2	7	4	10	16	10.5
Osage	15	-2	-3	4	0	6	2	15	4	-10	4	-6	-13	-14	-6	1	6	-3	3	22	21	16	8	18	-14	-14	4	-8	-6	3	4	2.6
Panama	17	13	12	29	22	16	20	20	22	9	18	8	2	0	-2	2	1	8	10	17	22	24	24	32	17	2	-6	6	-1	8	11	12.2
Richland	26	3	3	14	2	9	13	18	6	-4	8	2	6	-8	-2	-3	12	3	-1	7	25	24	25	34	14	2	2	8	4	5	14	8.6
Sac City	20	6	9	24	6	16	8	21	6	-2	3	-12	-9	-9	-2	0	13	3	10	25	24	23	26	29	23	6	-6	4	-5	4	4	7.8
Sioux City	26	10	13	30	10	22	14	26	23	2	20	7	3	-6	-6	-2	4	13	5	16	24	28	29	34	16	-6	-2	6	0	3	6	12.6
Storm Lake	22	16	7	24	18	11	13	16	18	-2	14	10	-2	-2	-5	-2	4	10	4	21	25	24	24	29	14	1	-8	6	1	1	6	11.1
Tipton	24	10	-3	15	12	3	13	10	15	-6	5	1	-8	-6	-4	7	5	14	6	26	28	28	24	29	16	6	1	16	4	13	16	9.3
Vinton	21	5	1	13	2	8	8	16	5	-5	6	-3	-6	-8	-7	-3	5	10	6	22	28	18	11	33	20	-8	3	11	-1	6	9	6.6
Villisca	..	31	24	29	36	18	27	16	..	..	12	20	10	-7	-7	7	12	14	8	14	28	24	31	33	22	0	5	16	4	16	23	11.9
Washington	27	9	4	18	7	8	14	12	10	-1	12	4	-3	-1	0	6	9	7	4	28	29	29	22	30	22	0	5	16	4	16	23	11.9
Webster City	23	4	4	24	2	12	5	22	3	0	12	4	-2	-8	-4	2	14	5	14	27	28	25	21	30	11	-10	-2	6	0	4	7	8.6
Winterset	24	8	8	21	8	6	8	12	10	6	15	4	-4	-4	-6	2	6	4	8	26	28	25	24	32	17	-4	-4	8	2	10	20	10.4
Williams	16	-6	1	12	4	8	11	18	6	-2	10	2	-4	-6	-4	2	6	2	6	24	26	24	22	28	16	-4	-2	8	-2	4	10	7.8

DAILY AND MONTHLY PRECIPITATION FOR JANUARY, 1893.

STATIONS.	DATE. 1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th	27th.	28th.	29th.	30th.	31st.	Total.
Ames (4 mi. S. W. of)	....	....	0.08	....	....	....	....	....	....	....	0.05	....	....	0 02	....	....	....	....	....	0.01	....	....	....	....	....	....	....	0.05	....	....	0.05	0.26
Ames (F. C. Stewart)	....	....	0 02	....	....	0.01	....	....	....	....	0.05	T	0.10	....	....	....	....	....	....	....	....	....	T	....	....	....	....	0.09	....	....	0.01	0.28
Ames (E. N. Eaton)	....	....	0.11	....	0 08	....	....	....	....	....	0.11	....	0.10	T	....	....	....	....	....	....	....	....	....	0.01	....	....	....	0.08	....	0.01	0.01	0.51
Amana	....	....	0.16	....	....	....	0.06	....	....	....	0.23	....	....	0.04	....	....	....	....	....	0.03	....	....	....	0 03	....	....	T	T	....	....	T	0.55
Algona	....	....	0.10	....	....	T	....	....	....	....	0.20	....	T	....	....	....	....	....	....	T	T	T	....	0.01	....	....	....	T	....	....	T	0.31
Alta	....	....	0.02	....	....	0.01	....	....	....	0.05	0.01	....	0.10	....	....	....	T	....	....	....	....	....	....	....	....	....	....	0.02	....	....	05	0.26
Atlantic	....	....	0.08	....	....	....	....	....	....	....	0.05	....	0.10	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.05	....	....	....	.....
Audubon	....	....	....	....	....	....	....	....	....	....	....	....	0.38	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.10	....	....	....	0.48
Belle Plaine	....	....	0.25	....	....	0.05	....	....	....	....	0 30	....	....	0.05	....	....	....	....	....	0 15	....	....	....	....	....	....	0.05	0.05	....	....	T	.90
Blakeville	....	....	0.30	....	0.10	0.10	0.15	....	....	....	0.50	....	....	....	....	....	0.05	....	....	0.20	....	....	....	0.30	....	....	....	0.30	....	T	0.20	2.20
Bonaparte	....	....	....	....	....	....	....	0 15	....	....	0.10	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.30	....	....	....	0.05	0.60
Cedar Rapids	....	....	....	0.15	....	....	T	....	....	....	0.12	0.08	0.04	T	....	....	....	....	....	....	0.11	....	....	0.04	0.02	....	....	0.04	0.10	....	0.02	0.72
Cedar Falls	....	....	....	0 30	....	....	....	....	....	....	0.60	....	....	....	....	....	....	....	....	....	....	....	....	....	....	T	T	0 20	....	0 20	0.10	1.40
Centerville	T	....	0.20	....	....	....	....	....	....	....	0.10	....	....	0.10	....	T	0.05	....	....	....	....	....	....	T	....	....	0.05	0.05	....	T	T	0.55
Charles City	....	....	0.25	0.10	....	0.10	....	....	0.10	....	0 40	....	....	....	....	....	....	0.03	....	0.03	0.03	....	....	0.25	....	....	....	....	0.20	....	....	1.49
Clarinda	....	0.25	....	....	....	....	....	....	....	....	0.20	T	....	....	....	T	....	....	....	....	....	0.28	....	....	....	....	....	....	....	....	....	0.68
Clinton	....	....	....	0.10	0.11	0.10	....	....	0.05	....	0 50	....	....	0.03	....	....	....	....	....	0.08	....	....	....	0.33	....	....	0.03	0.08	....	....	....	2.01
College Springs	....	....	....	....	....	0.05	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.10	....	....	0.05	0.20
Corning	....	0.10	....	....	....	....	....	....	....	T	T	T	....	....	....	T	T	....	....	....	....	....	....	....	....	....	0.05	0.10	....	T	....	0.25
Davenport	T	....	0.07	0.14	....	0.06	0.04	....	0.02	....	0.30	0.02	T	0.02	....	T	T	T	....	0.07	T	....	....	0.08	....	....	0.04	0.10	0.08	T	0.10	1.14
Delaware	....	....	0.10	....	....	0.10	....	....	....	0 02	0 11	....	....	....	....	....	....	....	....	0.11	....	....	....	0.15	....	....	0.10	0.15	....	....	0.02	0.86
Denison	0.10	T	....	....	....	....	....	....	....	0.15	0 05	0.10	0.45	....	....	T	0.20	....	....	....	....	....	....	T	T	....	T	0.10	....	T	....	1.15
Des Moines	T	....	0.09	....	....	T	0.01	T	T	0.01	0.03	T	....	0.17	....	T	....	T	....	T	T	....	....	T	....	T	0.08	0.08	0.06	0.02	0.01	0.56
Dubuque	....	....	0.01	0.05	....	0 08	....	0.06	....	0.28	....	0.15	....	....	....	....	....	T	....	0.16	....	....	....	0.44	....	....	T	0.08	0.24	....	0.08	1.66
Eagle Grove	....	....	0.20	....	0.12	....	....	....	....	0.20	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.15	0.70
Eldora	....	....	....	....	....	....	....	....	....	....	0.20	....	....	0.05	....	....	....	....	....	0.08	T	....	....	T	....	....	T	0.20	....	....	....	0.52
Emmetsburg	....	....	....	....	0.05	0.20	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.05	....	....	....	....	....	....	....	....	....	0.30
Fairfield	....	T	0.76	....	....	....	0.06	....	....	....	0 21	0.02	....	....	....	....	0.06	....	T	....	....	....	....	T	0 02	....	....	....	....	....	....	1.16
Fayette	....	....	0.04	0.13	....	0.01	....	T	T	....	0.32	T	....	....	....	T	T	....	....	0.12	....	....	....	0.34	....	....	T	0.05	....	T	0.04	1.05
Fort Madison	....	....	0.25	....	....	....	....	....	....	....	0 35	....	....	0.10	....	....	....	....	....	....	....	....	....	....	....	....	....	0.71	0.25	....	....	1.66
Grand Meadow	....	....	....	0.05	....	0.20	....	....	....	....	0.34	....	....	....	....	....	....	....	....	0.25	....	....	....	0.55	....	....	....	0.20	....	....	0.06	1.65
Galva	....	....	0.10	....	....	T	....	T	....	T	0.05	T	....	0.05	....	....	T	....	....	....	....	....	....	....	....	....	T	T	....	....	T	0.20
Glenwood	....	0.20	....	....	....	0.03	....	....	....	....	....	0.30	....	....	....	0.20	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0 73
Grinnell	....	....	....	T	....	T	....	....	....	....	T	T	....	0 05	....	....	....	....	....	0.05	....	....	....	....	....	....	....	0.32	....	T	....	0.12
Greenfield	0.05	....	0.10	....	....	T	....	....	....	0.01	0.01	T	0.05	....	....	....	....	....	....	....	....	....	....	T	T	....	0 03	0.20	T	T	T	0.48
Grundy Center	....	....	0.10	....	....	0.05	....	....	T	0.10	T	T	T	....	....	....	....	....	....	0.08	....	0.08	....	....	....	....	0.01	0.08	....	....	0.01	0.50
Hampton	....	....	0.15	....	....	0.10	....	....	....	....	0.33	....	....	....	....	....	....	T	....	....	....	....	....	0.06	....	....	....	0.18	....	....	....	0 82
Hawkeye	T	T	T	0.35	0 40	0.45	....	....	0.34	....	....	0.11	....	....	....	0.17	....	....	0.28	....	....	....	....	....	0.45	....	....	0.30	....	....	0.35	3.20
Hopkinton	....	....	0.10	....	....	0.20	....	....	....	....	0.20	....	....	....	....	....	....	....	....	0.20	....	....	....	0.30	....	....	....	0.10	....	....	0.10	1.20
Hopeville	....	....	0.05	....	....	T	....	....	....	T	T	....	0.02	T	....	T	T	....	....	T	....	....	....	....	....	....	T	0.10	....	T	....	0,17
Independence	....	....	....	0.35	....	....	....	....	....	....	0.37	....	....	....	....	....	....	....	....	0.15	....	....	....	0.37	....	....	0.17	....	....	....	....	1.41
Indianola	T	....	0.10	....	....	....	T	....	T	T	T	....	....	0.14	....	....	....	....	....	T	....	....	....	....	....	....	T	....	0.10	T	T	0.34
Iowa City	....	....	....	0.25	....	0.15	....	....	....	....	0.25	0.06	0.06	....	....	....	T	T	....	0.17	....	....	....	T	....	....	....	....	0.05	0.20	....	0.05	1.18
Iowa Falls	....	....	0.10	....	....	....	....	....	....	0.12	....	....	....	....	....	....	0.05	....	....	....	0.10	....	....	....	....	....	0.15	....	....	....	....	....	0.52
Keokuk	T	....	0.20	....	....	....	0.02	....	T	....	0.10	....	....	0.06	....	T	T	0.01	....	T	....	....	....	T	....	....	0.11	0.36	0.02	0.01	0.03	0.92
Keosauqua	....	....	0.06	....	....	T	....	....	....	....	0.07	T	....	0.03	....	T	T	0.02	....	T	....	T	....	....	....	....	T	0.20	....	T	0.02	0.49
Larrabee	....	....	0.02	....	....	T	....	....	0.01	0.03	T	0.02	....	....	....	0.01	....	....	....	....	....	....	....	....	T	....	....	0.02	....	....	0.02	0.13
La Crosse, Wis	....	....	0.03	0.05	....	0.12	0.01	....	T	....	0.31	0.01	....	....	....	....	T	0.02	....	0.04	....	....	....	0.24	T	T	T	0 03	0 20	....	0.04	....
Logan	....	0.10	....	....	....	....	....	....	....	....	0.20	....	....	0.10	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.40
Mt. Ayr	....	0.03	0.03	....	....	....	....	....	....	....	T	T	....	....	....	T	T	....	....	....	....	....	....	....	....	....	T	0.10	....	....	....	0.16
Marshalltown	....	....	0.18	....	....	....	....	....	....	0.08	....	....	....	0.05	....	....	....	....	....	....	....	....	....	....	....	....	....	0.15	....	....	....	0.44
Maquoketa	....	....	....	0.05	....	0.05	....	0.10	....	0.05	0 15	....	T	....	....	T	T	....	....	0.10	....	....	....	0 20	....	....	....	0.08	....	0.05	0.03	0.86
Mechanicsville	....	....	0.10	0 14	0.04	0.02	0.10	0.01	0.01	....	0.18	0.02	....	0.01	....	0.01	....	....	....	0.20	....	....	....	0.20	....	....	0.03	0.32	....	....	0.05	1.44
Milton	....	....	0.20	....	....	....	....	....	....	0.10	....	....	....	....	....	....	....	T	....	....	....	....	....	....	....	....	0.10	....	....	....	....	0.40
Monticello	....	....	0.07	0.08	....	0.15	....	....	....	....	0.27	....	....	....	....	....	....	....	....	0.12	....	....	....	0.28	....	....	0.07	0 08	....	....	0.06	1.18
Murray	....	....	....	0.05	....	....	T	....	....	T	T	T	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.18	....	....	0 23
Maxon	T	....	0.10	....	....	T	....	T	T	T	0 08	....	....	....	....	....	0.05	....	....	T	....	....	....	T	....	T	....	0.02	....	....	....	0 26
Newton	....	....	0.06	....	T	....	0.05	....	....	....	0.08	T	....	0.13	....	....	....	....	....	0.04	....	....	....	T	....	....	0.06	0.10	....	....	0.63	0.67
Omaha, Neb	....	0.14	T	....	T	....	0.01	....	T	T	0.03	T	....	T	....	T	T	T	....	....	....	....	....	....	T	0.01	0.01	0 07	....	....	0.01	0.28
Oskaloosa	....	....	0.10	....	....	0.04	....	....	....	T	T	0.13	0.20	....	....	....	T	....	....	....	....	....	....	T	....	....	T	T	0.12	T	T	0.59
Osage	....	....	0.20	....	....	T	....	....	....	....	0.40	....	....	....	....	....	....	....	....	....	....	....	....	0.20	....	....	....	....	0.02	....	0.03	0.85
Panama	....	0.08	....	....	....	....	....	....	....	....	....	0.07	....	0.14	....	....	....	....	....	....	....	T	....	....	....	....	....	....	....	....	....	0 29
Richland	T	....	0.18	....	....	0.04	....	....	....	....	0.32	....	....	0.11	....	T	0.01	....	....	T	....	0.20	....	....	....	....	0.22	....	....	....	0.02	0.92
Sac City	....	....	0.10	....	....	....	....	....	....	....	....	....	....	....	....	....	0.04	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.14
Sioux City	....	0.12	T	....	....	0.01	T	....	....	0.01	0 01	T	0.17	T	T	T	....	....	....	....	....	....	T	....	T	T	T	0.01	....	T	....	0.34
Storm Lake	....	....	....	0 02	....	....	....	....	....	....	0.07	T	....	....	....	....	....	0.06	....	....	....	....	....	T	T	....	....	....	0.02	....	....	0.17
Tipton	....	....	0.08	0.19	....	0.15	....	....	....	....	0.22	....	....	0.03	....	....	0.02	....	....	0.05	....	....	....	T	....	....	T	....	....	T	0.05	0.79
Villisca	0.10	....	....	0.20	....	0.05	....	....	T	T	0.05	....	....	....	....	T	....	....	....	....	....	T	....	T	....	....	0.05	T	....	....	....	0.20
Vinton	....	....	....	0 16	....	....	....	....	....	....	0.30	....	T	....	....	....	....	....	....	0.30	....	....	....	....	....	....	0.10	....	....	....	....	0.86
Washington	....	....	....	....	....	....	....	....	....	....	0.30	....	....	....	....	....	....	0.11	....	0.09	....	....	....	....	....	....	....	0.23	....	....	....	0.89
Webster City	....	....	0.25	....	....	0.01	....	....	....	....	0.25	0.12	....	....	....	....	....	....	....	0.08	....	....	....	T	....	....	T	....	....	....	0.02	0.73
Winterset	....	....	0.18	....	....	T	....	....	T	....	0 10	....	....	....	....	....	....	....	....	....	....	....	....	T	....	....	0.05	0.25	....	....	....	0 52
Williams	....	....	0.11	T	....	0.02	....	....	....	....	....	....	....	....	....	....	....	....	....	0.05	....	....	....	0.07	....	....	....	....	0.03	....	0.05	0.33

METEOROLOGICAL STATIONS AND OBSERVERS.

From the following, weekly and monthly reports of Meteorological data are received by the Iowa Weather and Crop Service.

Albia	Geo. Price.
Algona	Jas. Barr, M. D.
Alta	D. E. Hadden.
Amana	Conrad Schadt.
Ames	E. C. Dickinson.
Ames	E. N. Eaton
Ames, (4 miles S. W.)	Isaac Young.
Atlantic	J. W. Love.
Audubon	J. F. Hocker.
Belle Plaine	H. W. Vandike.
Blakeville	James Rodgers.
Blockton	C. W. Thompson.
Bonaparte	Hon. B. R. Vale.
Carroll	Moses Simon.
Cedar Falls	Prof. A. C. Page.
Cedar Rapids	H. D. Olds.
Centerville	J. I. Ong.
Charles City	J. W. Smith.
Clarinda	A. S. Van Sandt.
Clinton	Luke Roberts.
College Springs	A. A. Berry.
Concord	J. M. Elder.
Corning	John W. Bixby.
Corning	Jerome Smith.
Corydon	J. S. Whittaker.
Cresco	Gregory Marshall.
Davenport	*F. J. Walz.
Delaware	Wm. Ball.
Denison	P. H. Schlumberger.
Des Moines	*Geo. M. Chappel.
Dubuque	*S. C. Emery.
Eagle Grove	C. A. Schaffter.
Eldora	Prof. C. F. Woodward.
Elkader	G. A. Fairfield.
Emmetsburg	H. Conroy.
Estherville	R. M. McKean.
Fairfield	J. Fred Clarke, M. D.
Fayette	R. Z. Latimer.
Ft. Madison	Miss L. A. McCready.
Galva	Dr. D. W. Farnsworth.
Glenwood	Seth Dean.
Greenfield	J. G. Culver.
Grinnell	Prof. S. J. Buck.
Grundy Center	Chas. G. Rogers.
Hampton	E. C. Grenelle.
Havelock	P. H. Joquillette.
Hawkeye	J. W. Bopp.
Hopeville	M. T. Ashley.
Hopkinton	Theo. Marks
Independence	E. F. Wulfke.
Indianola	Prof. J. L. Tilton.
Iowa City	Prof. A. L. Arner.
Iowa Falls	J. B. Parmelee.
Keokuk	*Fred. Z. Gosewisch.
Keosauqua	Prof. J. H. Landes.
Larrabee	H. B. Strever.
La Crosse, Wis	*W. U. Simons.
Logan	Mrs. M. B. Stern.
Mason City	Edw. E. Wilcox.
Manson	W. L. Thompson.
Marshalltown	L. S. Kilborn.
Maquoketa	Dr. A. B. Bowen.
Mechanicsville	Rev. J. W. Hubbard.
McCausland	Miss Ruby Pearl Barr.
Milton	Hon. E. C. Holland.
Mooar	F. G. Thomas.
Monticello	Henry D. Smith.
Mount Vernon	Prof. A. Collin.
Murray	A. W. Lewis.
Muscatine	J. P. Walton
Newton	A. Lufkin.
Omaha, Neb	S. S. Bassler.
Osage	G. D. Pattingill
Oskaloosa	Jos. Boyd.
Panama	Wm. J. Wicks.
Postville	F. L. Williams.
Richland	Wm. A. Shaffer.
Sanborn	T. D. White.
Seymour	Hon. L. W. Lewis.
Sibley	G. W. Baxter.
Sidney	G. V. Swearingen.
Sioux City	*U. G. Pursell.
Spirit Lake	R. B. Young.
Storm Lake	A. J. Bond.
Tipton	J. M. Rider.
Vinton	T. F. McCune.
Villisca	Hon. J. S. Boise
Washington	Wm. A. Cook.
Webster City	C. M. Trumbauer.
Winterset	Will McKnight.
West Bend	Phil. Dorweiler
Williams	M. L. Fuller.

*U. S. Weather Bureau.

WEATHER-CROP OBSERVERS.

Reporting for the Weekly Bulletin.

Afton	M. V. Ashby.
Agency	J. H. Van Zant.
Ames	Henry C. Wallace.
Albia	Wm. Mercer.
Anita	I. A. McKinley.
Ankeny	Ed. Parmenter.
Battle Creek	A. Preston.
Bloomfield	Geo. Duffield.
Boone	L. C. Morris.
Carbon	N. M. King.
Carson	G. N. Ferguson.
Centerville	Henry Galley.
Charles City	W. B. Towner.
Chariton	M. J. Burr.
Clarksville	F. M. Russell.
Clermont	Chas. Larrabee.
Council Bluffs	L. Prouty.
Dedham	J. W. Kay
Danville	Sherman Matthews.
Emerson	D. B. Nims.
Fontanelle	W. H. Bridgman.
Ford	W. W. Whitmore.
Fort Dodge	R. W. Blaine.
Geneva	Wm. H. Thompson.
Hodge	James Piper.
Humboldt	G. L. Tremain.
Hamlin	F. P. Moore.
Humeston	S. H. Moore.
Independence	C. L. Thomas.
Indianola	T. B. Hammer.
Iowa City	A. O. Price.
Jefferson	S. M. Taylor.
Leon	John Daykin.
Larrabee	H. H. Carnahan.
LeMars	Hon. Henry Schrooten.
Ledyard	Frank Miller.
Lawler	Hon. Wm. Glattly.
Lockridge	John F. Farman.
Manning	H. W. Pollock.
Mapleton	A. Lamb.
Marshalltown	Hon. J. G. Brown.
Mason City	Wm. Nettleton.
Mt. Ayr	Hon. Wm. Shriver.
Mt. Pleasant	W. S. Wright.
Minburn	J. W. O'Brien.
Mount Vernon	Robert Smith.
Newton	J. P. Beatty
North English	J. L. Williams.
Nevada	O. G. Ashford.
Osage	E. W. Stacy.
Orange City	H. J. VandeWaa.
Paton	Hon. Joshua Jester.
Pittsburg	G. C. Duffield.
Polo Station	A. E. Miller.
Prescott	G. W. Iden
Paullina	Geo. Hakeman.
Rockwell City	J. G. Palmer.
Rock Rapids	D. E. F. Merrill.
Rossville	F. B. Wiley.
Sac City	Dr. C. Brown.
Sandusky	Z. Hollingsworth.
Sageville	Hon. F. N. Knell.
Shenandoah	Reuben Mullison.
State Center	E. N. Thompson.
Sumner	John Dawson.
Tama	W. G. Malin.
Van Horn	Spencer Smith.
Wapello	O. P. Smith.
Waukee	John Wragg.
Wheatland	D. Beckman.
Winterset	H. A. Kinsman.
Wyoming	R. A. Norton.
Wall Lake	T. E. Wilcox
Yankee	W. S. Nicholson.
Walnut	F. L. Martin.
What Cheer	O. D. Lawrence.

THE IOWA WEATHER AND CROP SERVICE

Was established by act of the Twenty-Third General Assembly, and placed under supervision of the Board of Directors of the State Agricultural Society, constituted as follows:

OFFICERS.

President—J. W. McMullin, Oskaloosa, Mahaska Co.
Vice-President—John A. Evans, West Liberty, Muscatine Co.
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J. W. McMullin. John A. Evans, John R. Shaffer.

U. S. Department of Agriculture---Weather Bureau.

MONTHLY REVIEW

OF THE

IOWA WEATHER AND CROP SERVICE.

VOL. IV.] FEBRUARY, 1893. [NO. 2.

EDITORIAL NOTES.

The storm losses on the Montana cattle ranges are reported to be fully 25 per cent.

***

The largest war vessel in the navy is to be called the "Iowa," and it is suggested that an ear of corn be put on the prow as an emblem of the State. We object. Neither corn, nor hogs, nor horses, nor cattle, are the truest exponents of Iowa's position in the nation. The manhood and womanhood of the State represent it correctly. Take the Iowa girl as a figurehead.—*Hon. Jas. Wilson.*

***

Iowa steps close upon the heels of stately New York as a butter producing State, says the *Creamery and Dairy.* Bovina, New York, is the banner township of New York, but Iowa can show an entire county that shipped out three tons of butter for every square mile of its territory. And it was all made with the cheapest feed and sold equal with any. The name of this county is Bremer. It contains twelve congressional townships of thirty-six miles each, and Dairy Commissioner Tupper reported its gross shipments last year at 2,632,693 lbs. Figure this out and meditate upon the answer.

***

At the present price of pork, corn judiciously fed to hogs is worth 85 cents per bushel. As a rule the home market is the best.

***

Hail, gentle spring!! N. B. This is merely a salutation and is not to be taken literally.

***

It is reported that many shallow ponds have been frozen solid this winter, and thousands of fish have been destroyed.

***

There was a vast expanse of territory covered by snow at the close of February, as shown by the graphic map issued by the Weather Bureau. The southern limit of snow ran from central Utah eastward to the Atlantic very nearly parallel with the 40th degree of latitude. It covered all but a small fraction of this State. The greatest depths reported were Portland, Me., 31 inches, and St. Vincent, Minn., 28 inches.

***

In an article on the Department of Agriculture the *American Agriculturist* summarizes the work of the Weather Bureau in flattering terms. It says: "In the transfer of the Weather Bureau to the Department, it was specifically provided that it should 'be hereafter specially developed and extended in the interests of agriculture.' The reports of this Bureau show the great advance it has made in this direction since its transfer to Secretary Rusk's Department. New stations have greatly multiplied, local forecasts have enlarged their territory to cover entire states, twelve new State Weather Services have been established, over 200 voluntary observers have been added to the regular force, 1,300 new display stations secured, an increase of more than 3,000 daily maps are issued from the stations, while twenty additional lines of railroads now telegraph forecasts to all their stations, free of expense, to the Bureau. In addition to what all this implies, and which has immensely increased its practical efficiency, the Bureau is also making substantial progress with such questions as the use of smoke in preventing frost injury, the development of the use of wind power, the feasibility of thunder-storm predictions, the climatology of special crops, of special states, of certain localities, together with the currents and fogs of the great lakes. These items show how fully this Service is now in touch with the farming element of the country."

***

It is said that two lawyers, Hon. John Y. Stone, of Mills county, and Hon. Ben. McCoy, of Mahaska, own the two largest apple orchards in Iowa. They raise wholesome fruit and stimulate a noble industry, while some others of their profession cultivate only apples of discord in communities.

***

Inauguration day is proverbially stormy at the national capital, where vast crowds assemble to witness the quad-

rennial ceremonial. Is the atmospheric disturbance the result of the shoutings, jam and sweat of humanity, and intense excitement of the occasion? This matter is respectfully referred to the gentlemen who have some faith in the production of rain by jarring the skies.

***

In a communication to the meteorologist of the Maryland Weather Service, Prof. Cleveland Abbe says: "The fact that rapid or special showers of rain follow after loud claps of thunder may be offset by the fact that a still greater number of such showers occur without any thunder. Now thunder is the consequence of a special electrical discharge, and electricity is invariably present in the atmosphere. We are living upon a highly charged conductor, which is discharging through our atmosphere into an upper region. The air, in this upper region, is flowing from the equator to the poles; here and there the upper air descends, while in other places it ascends. Our thunder storms occur in the ascending districts, and our auroras in the descending. It is very likely that there is some connection betweeen the electrified condition of the atmosphere and the condensation of aqueous vapor, and some features of this connection have been demonstrated by laboratory experiments. We can show that the noise of the thunder, in and of itself, is not likely to cause the formation of rain; but the electrified condition, or the change in that condition that attends the lightning may possibly be of some importance. So far as my own observations go, however, I find that it is only after the rain has been formed and has fallen half-way down to the earth, that the lightning flash and the thunder occur. Apparently the falling raindrops bring down a charge of electricity from the clouds, thus bringing about a deficiency above and an excess below, so that a discharge and a flash may occur either from the rain to the ground, or between neighboring clouds in the upper regions."

***

A writer in Longman's Magazine says: "A very curious fact is that a cloud is always raining. Even in summer, when the cloud over our heads is white, the drops are falling from it. But they are very small, and they evaporate before they reach the earth. In evaporating they pass from the cloud-particle stage to the haze-particle stage; from saturation to simple condensation, or the dry dust particles on which the condensation took place may be left perfectly dry. It is a general truth that when a cloud is formed it begins to rain. The minute particles of water come down in millions. The distance they fall depends on their size. If the air the cloud rests on is dry and warm they do not get far. If it is chilly they collect in masses and form drops of rain that reach the earth."

***

The March crop report of the Department of Agriculture gives the following estimate of the quantity of last year's crop, wheat and corn on hand: The estimated proportion of wheat on hand is 26.2 per cent of the last crop, the smallest percentage in ten years. The quantity on hand aggregates 135,000,000 bushels, 66,000,000 bushels less than last March and 23,000,000 more than the remnant of the very small crop of 1890. A very large proportion is found in the States that do not spare a bushel for commercial distribution. There are only 34,000,000 bushels in the principal spring wheat States, more than half of which is required for seed in the spring. Of the winter wheat States, only Kansas and California have any considerable surplus available for commercial distribution.

The consumption of corn for the eight months is 1,001,616,630 bushels and only exceeds that following the smaller crop of 1887 and 1890. The aggregate sold from the farms to go beyond the county lines is 277,379,000 bushels or 17 per cent of the crop. The proportion of merchantable is 1,345,445,000 bushels or 82.6 per cent. The values returned for the merchantable crop averages 42.9 cents; for the unmerchantable, 27.7 cents, making an aggregate of $655,000,000 which exceeds the December valuation by $13,000,000, averaging 40 cents per bushel. The amount exported in the twelve months is 191,000,000 bushels; required for consumption, 300,000,000; seed used, 54,000,000; visible stock, 79,000,000; a total of 624,000,000 bushels against the apparent supply of 729,000,000 bushels. There is therefore an apparent excess of distribution from the last two crops of 31,000,000 bushels, compared with previous estimates, showing, if the present estimates are correct, which cannot be positively assured, that the crops of 1891 and 1892 were under-estimated by 2 or 3 per cent, which would be a very close margin on the safe side.

***

Perfect forms of snow crystals have been enumerated and figured by the various investigators in that line. One hundred and fifty-one different forms were once observed by the English scientist, Glashier, who carefully made engravings of each and printed them in a paper attached to the report of the British Meteorological Society for the year 1855.

***

Yes, we grumbled when it froze,
And our ears we wrapped in plush,
And our feet we could not keep,
And we grumble now because,
As the weather warmer grows,
And it thaws and thaws and thaws,
We must wade around in slush
Six or seven inches deep.

—*Kansas City Journal.*

***

A recent press dispatch from New York says: The steamship Picqua, from Mediterranean ports, which passed Gibraltar on February 14th, had a mighty battle to keep afloat in a cyclone on Saturday last, when 400 miles north of Bermuda. She put out a triangular sea anchor made of fenders covered with boards and weighted on one side with grate bars and lay with her head to the riot from 9 A. M. until 8 P. M. She took in the anchor at 11 P. M. and proceeded slowly. She passed through the southerly edge of the cyclone at 11 P. M. It was skulled with waterspouts, which would have been tornadoes ashore. They seemed to be all around the ship. None of them struck her, but they sucked up seas that the Picqua's captain says were forty feet high. Two of these giants roared over the Picqua's starboard, smashing the forecastle head, carrying away the ladder to the bridge and

thirteen ventilators, and smashing the wheelhouse. While the waterspouts were pirouetting madly like crazy skirt dancers around the ship, the trucks and the ends of every spar glowed with St. Elmo's fire, and lightning seared the blackness. Two seamen were badly hurt by being thrown against the iron deck house. The Picqua ran eleven hours before the tempest, then she hove to and put out her sea anchor again. The storm let up next day and she went on her course.

***

Among the forthcoming publications of the United States Department of Agriculture is one presenting the results of a collaboration of official statistics of all countries in the world, so far as obtainable by the most diligent research, relating to the production and distribution of the principal products of agriculture. Ninety-two countries are represented in the work, and wherever annual statistics are available, the figures are given for ten consecutive years. There are necessarily gaps in the annual series, many countries failing to make yearly enumerations of products, while in others the requisite trade records have not been published. Still, so far as possible, a systematic average of a series of years has been compiled, it being impossible to make use, for practical deductions, of the record of a single year in any country, owing to the fluctuations of annual production, both in the area, rate of yield, and trade requirements. In his letter of submittal, the Statistician thus emphasizes the difficulty and magnitude of the work: "It involves translation from many languages, reductions of weights and measures, nearly as numerous as the countries represented, the collection of consecutive annual statements for a period of ten years, the ascertaining of the average population of each country for that period, and the orderly arrangement of hundreds of separate tables, primarily between a thousand and two thousand."

RULES FOR FORECASTING, AT DAVENPORT, IA.

Changes in the weather and changes in the wind are so closely related and dependent that no single element is of more importance than the winds. Hence, in my studies for aid in forecasting coming weather changes, my attention has been necessarily given chiefly to a study of the winds, both as a means of indicating coming changes and a cause for these changes.

From ten years' record of this station (1882 to 1891 inclusive), I have prepared the following tables for wind directions at the morning observations:

Relative percentage of wind direction for the year at 8 a. m.

N	NE	E	SE	S	SW	W	NW	Calm
6	9	16	5	6	21	15	15	7

Relative percentage of wind direction at 8 a. m., followed by .01 or more inches of precipitation within 36 hours.

N	NE	E	SE	S	SW	W	NW	Calm
3	8	27	10	10	18	12	9	3

Relative percentage of wind direction at 8 a. m., followed during the succeeding 36 hours by fair weather.

N	NE	E	SE	S	SW	W	NW	Calm
	9	10	2	4	23	17	18	9

Percentage of each direction of wind at 8 a. m., followed by precipitation within 36 hours.

N	NE	E	SE	S	SW	W	NW	Calm
23	38	66	78	64	35	38	26	20

A glance at these tables shows that the prevailing winds in this locality, for the year, at 8 A. M., are southwest; the least frequent, southeast. The direction of the wind at 8 A. M., mostly followed by rain or snow, within 36 hours, is east; southwest, second; the direction least often followed by rain or snow being north (and calm).

The direction at 8 A. M., mostly followed by fair weather is southwest; while 58% of the fair weather was preceded at 8 A. M. by winds from a westerly direction. Southeast winds are followed by the least fair weather. Of the southeast wind at 8 A. M., 78% were followed within 36 hours by precipitation; of the north winds, 23%.

The foregoing demonstrates that with an east, southeast or south wind in the morning, precipitation should be predicted, if other conditions justify; while with a north or westerly wind or calm, fair weather would be the rule.

The storm disturbances, which pass over this section, come almost universally from the northwest or the southwest and move in an easterly direction, therefore to forecast coming weather changes from a study of the weather map, it is necessary to locate first, the centers of these disturbances and the atmospheric conditions comprising them, such as relative barometric pressure, gradient, direction of the winds, temperature, humidity, and the existing weather.

From these and the observed laws of storms, both as to their action and movement, judge what quadrant of the disturbance will overspread, pass through, or prevail over our section during the time for which the forecast is made.

The area of storm disturbance, which varies from 300 to 1,500 miles in diameter, may be divided into four quadrants, each showing and usually maintaining distinct features and atmospheric characteristics.

The northeast quadrant has high relative humidity, heavy and increasing cloud formations, brisk easterly winds and usually, especially in southern portion, rising temperature; also the greatest precipitation. The southeast quadrant contains the greatest heat and highest absolute humidity, with winds south to southwest; it is also the region of severe local or secondary storms. The southwest quadrant contains fair to clear weather, westerly winds and diminishing humidity. The northwest quadrant gives fresh and cool northerly winds, clear weather, and has the least heat and moisture.

A storm area appearing in the northwest, if the tendency of its movement is in a southerly direction, the weather with it fair and the temperature rising; fair weather and warmer in this locality should be expected during the next thirty-six hours, with winds from the south backing to the east as the storm approaches, and becoming westerly after the storm area has passed. A storm area forming in the southwest, with warmer humid conditions and a northeasterly movement, would foretell, especially if the local winds were east or northeast, warm rains.

Storm areas reaching this station from the southwest usually bring heavy and general rains. Those from the northwest, rainy weather or fair weather, according to whether their centers pass south or north of Huron, South Dakota. Also, storms from the southwest nearly always give warmer weather with precipitation; while those from the northwest give warmer temporarily with precipitation or fair weather, according to its form, relative temperature, humidity, and other local conditions; both are usually followed, however, by westerly or northerly winds and colder. A cold wave hardly ever follows any other than a northwest storm, and is always accompanied by sudden and rapidly rising barometer, forming an area of "High."

Winter storms are usually heralded by an area of "Low" of considerable intensity appearing in the northwest; they are preceded by southerly or easterly winds with rising temperature, cirrus clouds, thickening into stratus and are followed by rain or snow, if the temperature of the storm is higher than that of the great central valleys, but by fair weather if the temperature is lower. These storms move to the east of the Rocky Mountains, passing down the Missouri and across the Mississippi valley; they are nearly always followed by westerly winds and often by a severe cold wave.

Wind-storms are usually preceded by a rapid fall in barometer, with winds veering from southerly to westerly and immediately followed by a rapidly rising barometer; the winds generally increase in force with the change. Nearly all high winds, that is winds with a velocity of forty miles per hour or more, are from a westerly direction, and occur usually in from one to five hours after the sudden rise in barometer begins.

Wind velocity in all cases depends directly upon the gradient of the storm.

The local conditions that precede storms producing rain or snow are usually a falling barometer with rising temperature and winds from east to southeast; cirrus clouds forming in the west developing into cirro-stratus; atmosphere hazy or of a dull whitish appearance. This condition will most probably be followed by a storm from the northwest; while if the storm was approaching from the southwest the winds would more likely be east or northeast.

Rising barometer with an area of "High" in the west or northwest, and winds westerly nearly always bring fair and cooler weather.

Severe local storms are usually preceded by a sudden and rapid fall in barometer, rising temperature, low humidity and heavy cumulo-stratus clouds forming in the west. Thunder-storms are preceded by a low or falling barometer, especially an oscillating barometer—or where the barograph record shows a jagged, downward movement—unusually high temperature with low cumulus clouds in the west, the winds southerly shifting suddenly to the northerly.

It has been observed that when cirrus clouds form, especially in the evening, and gradually turn into cirro-stratus, that rain follows within 36 hours; also, that in all well defined solar or lunar halos are followed by rain or snow in a very short time, especially if they appear successively. It has also been noticed, that, if on the morning weather map the winds at Rapid City, Valentine, Huron and Yankton point in towards each other, a storm will soon develop and bring precipitation in this locality within 36 hours, even though a storm area does not appear in that vicinity at that time. (This is given only as an observed fact.)

As this district is situated in the center of a large rolling prairie country, and no mountains or high hills within several hundred miles of this station, the storm movements and weather changes are not so much affected or modified by the topography of the country. The influence of the Great Lakes and the large water courses are, however, an important feature.

It has been observed that several local thunder storms, in the summer time, approaching from the southwest, usually divide at a point about two miles below this city; a part of the storm passing to the north up what is known as Duck Creek valley, the other part crossing the Mississippi river into Illinois and passing south along Rock river. This phenomenon is a noteworthy fact at this place and had protected the city from the extreme severity of a great many storms of this class. It is attributed to the high bluffs along the river at this place in connection with the abrupt turn in the river at the point where the storm divides.

The various weather conditions are, of course, so practically innumerable that strict and rigid rules for forecasting cannot be laid down; and, any arrangement or division of these conditions into groups for this purpose, is met with so many exceptions that any set rules for weather prognosis, so based, proved almost practically useless. The forecaster must usually rely upon his own judgment, experience and study, together with the general laws of meteorological and physical science, to group the conditions in each case for himself so as to be able to arrive at the proper conclusion in predicting weather changes from the then existing weather conditions. It is also necessary for him to have a thorough knowledge of the normal conditions for both the season and the time.

The foregoing are given as rules applicable only in a general way.

F. J. WALZ,
Observer, Weather Bureau, Davenport, Iowa.

From the Homestead.

HAIL-STORM INSURANCE.

The object of all insurance is to equalize losses. In modern times it covers almost everything, buildings, live stock, in fact, there is scarcely any risk that is not being covered by some form of insurance. The destruction of crops by hail in the last few years has led to the organization by the farmers of mutual hail insurance associations, the purpose being to reduce the cost of the risk to the lowest limit, on the same principle that has been adopted by the Farmers' Mutuals for the reduction of the risk from fire and lightning to the minimum. One result of the agitation has been the organization of a Mutual Associa-

tion of the State of Iowa, comprising some of the best and most experienced mutual insurance men in the State. Among the incorporators we find the names of Mr. W. D. Forbes, a prominent member of the State Alliance and president of the Sac County Mutual Insurance Association; Mr. W. A. Rutledge, secretary of the same; Mr. J. B. Herriman, secretary of the Iowa Mutual Tornado, Cyclone and Windstorm Insurance Association, which has met with the wonderful success so well known to our readers; Mr. S. W. Johnson, secretary of the Farmers' Mutual Live Stock Association, and Mr. C. E. Harsh, secretary of the Farmers' Mutual Association of Polk county. Among the directors we find other prominent mutual insurance men of the State, which gives the assurance that the association just organized will be honestly and fairly conducted.

The plan of the association is a marked improvement over the old plan of insuring so much per acre for any given number of acres on some particular crop. The new plan is to take so much on a quarter section, or a proportional amount on the divisions of a quarter section, the insurance to apply to any crop grown on the specified lands that may be mentioned in the by-laws. The assessment will be made on the same plan in use by the Farmers' Mutuals.

Hon. J. R. Sage, director of the Weather and Crop Service, reports that the average destruction by hail-storms in Iowa is about one-fifth of one per cent each year, and the assessments to cover such losses should be in the same proportion. The usual charge by stock companies is from twenty-five to fifty cents per acre, or from ten to twenty dollars per forty acres. It is believed that on the mutual plan this cost can be reduced from one-third to one-fifth of the above amount. Whatever the cost may be it will be in proportion to the risk, and be limited to the amount necessary to pay losses and necessary expenses of administration. In Nebraska, which is more subject to hail-storms than Iowa, the Hail and Windstorm Association paid all losses and expenses with ten cents per acre. While Iowa is less subject to hail-storms than Nebraska, yet in the best years every part of the State has suffered more or less from hail-storms. In no hail or tornado insurance is there any moral hazard, as no one can invoke the aid of either the tornado or hail-storm to destroy a poor crop. Every loss, therefore, must be an honest one, and every cent paid goes to help some unfortunate person, with whom the loss of a single crop may mean bankruptcy. The plan of the organization with by-laws and full particulars will be sent free to any reader of the *Homestead* on application to Mr. W. A. Rutledge, Early, Sac county, Iowa.

IOWA HORTICULTURAL EXHIBIT.

Hon. C. L. Watrous, Superintendent of the Iowa Horticultural exhibit at the Columbian Exposition, has issued the following circular to all who desire to become exhibitors in that line:

DES MOINES, Iowa, March 12, 1893.

My Dear Sir:—The time for printing the Official Catalogue of the World's Columbian Exposition is close at hand, and names of intending exhibitors must be sent forward if they appear in the catalogue.

It is desired that the showing of Iowa fruits shall be such that the world may know the greatness of our State in that important particular. The state will pay all expenses of shipping and displaying the fruit, and individual growers may have their card on the plates or packages showing the name, residence or business of the contributor. Also, in the Official Catalogue each exhibitor will be allowed the *free* insertion of his name and address, also the numbers and names of the articles exhibited. Additional advertising will be charged for at the rate of five dollars per line of thirty-three letters.

I desire, therefore, to have a list of the kinds of fruits which you will contribute in case we have a favorable season; as apples, plums, cherries, strawberries, raspberries, gooseberries, etc., as the case may be. This will cost you nothing, and will create no obligation more than to assist by contributing according to your ability of the fruits mentioned, provided the season is favorable and the fruits grow and mature well.

Meanwhile I want your name for the catalogue, with your estimate of what sorts of fruits you can contribute, as above stated.

Please let me hear from you at once, that I may be able to place your name among the others.

C. L. WATROUS.

NATIONAL WEATHER CROP BULLETIN.

WASHINGTON, D. C., March 1, 1893.

TEMPERATURE.—The month of February, 1893, has been colder than usual throughout all sections, except the southern portions of the south Atlantic and east Gulf states and New Mexico. Over the regions named there has been a slight excess of temperature, but over all other agricultural districts the daily mean temperature ranged from 3° to 9° below the normal. The coldest region includes Montana and adjoining states, where the departure from the normal ranged from 6° to 9°. It was also unusually cold in the central Mississippi valley, where the departure from the normal exceeded 6°, while in the Atlantic coast districts and on the Pacific coast, the month, although colder than usual, the mean temperature differed but slightly from the normal.

During the first week of February the temperature was unusually low over the northwest, and including the greater portion of the winter-wheat belt from Illinois westward to Kansas, and the second week was still more trying over the entire winter-wheat belt, owing to unusual cold and ice, while the third and fourth weeks of the month were more favorable, although the average temperature over this region was below the normal.

Referring to the Monthly Weather-Crop Bulletins for the season it will be seen that the entire winter has been colder than usual over the principal agricultural districts, the only month showing an excess of temperature since October over any extensive portion of the country is the month of January, during which it was warmer than usual in the Rocky Mountain districts, but it was unusually cold over the eastern half of the United States. The records, therefore, show that the principal farming districts have experienced four consecutive months of unusually cold weather.

PRECIPITATION.—There has been an excess of rainfall generally over the districts east of the Mississippi during the month of February, except in Florida, southeast Alabama, and southwest Georgia. Slight excesses in precipitation are also reported in the spring-wheat region and in Oregon, Washington, and northern California.

The month was relatively dry in the Mississippi Valley, Missouri, Kansas, and the Southwest. Compared with the January chart of the Weather Crop Bulletin it will be seen that the large deficiency then reported to the east of the Mississippi, excepting Illinois, has been replaced by excessive rains and snows during the current month, and while the January deficiency in the Mississippi Valley and southwest has been followed by a further, but slight deficiency during February. It should be noted, however, that this region received heavy rainfalls during December, 1892.

At the close of the month the country was covered with snow generally in districts north of the 40th parallel from New England westward to the Rocky Mountains, the depth of snow over the greater portion of New England, the Lake region, and Minnesota, exceeding 12 inches, and in some places in New England, Minnesota, and Wisconsin, exceeding 30 inches. The greater portion of the winter wheat has been unprotected during the month although the northern portion of the belt is now covered with snow.

MARK W. HARRINGTON,
Chief of Weather Bureau.

THUNDER-STORMS AT ALTA, IOWA.

During the years 1890-91-92 about one hundred and forty distinct thunder-storms were noted at or near this station, a thunder-storm being understood to mean lightning accompanied by thunder, whether it be but a single flash of lightning with thunder, or a continuous storm lasting several hours; with or without precipitation, and at intervals of not less than six hours apart.

From a brief study of the data thus at hand the following results were obtained: During the three years' observations, thunder-storms have occurred in months of March to October, no thunder-storms being observed in months of November, December, January and February—with one exception, viz., December, 1891.

June is the month of maximum, and March the month of minimum frequency; 21.4 per cent, or an average of ten thunder-storms per month, occur in June, while March does not average quite one storm per month.

In the following table the first column of figures shows the average number of thunder-storms in each month, the second column the per cent of frequency in each month for a period of three years, and the third column, the average frequency of auroras for a period of two years during the thunder-storm season.

MONTHS.	THUNDER-STORMS.		AURORAS.
	Average number.	Frequency.	
March	0.7	1.4	2.7
April	5.3	11.4	1.3
May	6.0	12.8	1.7
June	10.0	21.4	0.3
July	8.3	17.8	1.3
August	7.6	16.4	2.0
September	6.7	14.3	3.7
October	1.7	3.5	2.7

Auroras and thunder-storms seem to bear a reciprocal relation to each other; as will be observed in the above table, when thunder-storms reached their maximum, auroras were at their minimum, *i. e.*, in June, and auroras reached their maximum in months of less thunder-storm frequency. This interesting phase of the subject is at present in progress of investigation by Dr. M. A. Veeder, of Lyons, N. Y., who is giving the matter careful and thorough study.

Thunder-storms occur at all hours of the day and night, but are more frequent near the hours of maximum electrical potential of the atmosphere. The subjoined table exhibits the diurnal periodicity of the three years' observations. The first column represents the twenty-four hours divided into periods of two hours each, in which has been entered the time of beginning of each thunder-storm. The second column indicates the total number of storms, and the third column, the per cent of frequency in each two-hour period:

HOURS.	THUNDER-STORMS.	
	Total No.	Frequency.
12 to 2 A. M.	22	8.5
2 to 4 A. M.	10	7.1
4 to 6 A. M.	12	8.5
6 to 8 A. M.	11	7.9
8 to 10 A. M.	10	7.1
10 to noon	5	3.6
12 to 2 P. M.	6	4.3
2 to 4 P. M.	11	7.9
4 to 6 P. M.	13	9.3
6 to 8 P. M.	27	19.4
8 to 10 P. M.	15	10.8
10 to midnight	7	5.0

From an inspection of the above table it will be observed that the chief maximum is in the late afternoon, between the hours of 6 to 10 p. m., during which period over 30 per cent. of storms occur; a secondary maximum takes place between midnight and sun-rise. The chief minimum occurs from 10 a. m. to 2 p. m., with a secondary minimum near midnight. In order to ascertain whether this periodicity was also the case in each of the three years, the data were graphically platted for each year, and the resulting curves of maxima and minima coincide almost precisely.

The major part of the summer thunder-storms occurring during months of June, July, and August, are of a local character, sometimes exceedingly energetic, being accompanied by heavy rain, hail, and wind; and are occasionally quite destructive. It is noteworthy that in the case of such local thunder-storms, the direction of the wind previous to the storm has been either southwesterly or northeasterly, twelve to four hours before its occurrence.

DAVID E. HADDEN.

Alta, Iowa, March 3, 1893.

AURORÆ BOREALES AT ALTA, IOWA.

February 4, 1893.—First observation at 6:50 P. M., when bright aurora was present. It consisted of an arch with segment; altitude about 20 degrees; it extended from northwest to northeast. Very bright beams of bright greenish light, extending from the horizon to the top of the arch, traveled from a point north northeast to a point almost due north. Light stratus clouds were observed immediately above the dark segment arch, which, passing between some of the second magnitude stars of the "dipper," entirely obscured them. No streamers were observed reaching higher than the arch. The aurora reached its maximum brilliancy about 7:30 P. M., after which it remained quiescent for several hours, fading out after midnight.

About 8 P. M. and later the entire northern sky was covered with dark small stratus clouds, but in no other portion of the sky, and which also disappeared when the aurora did. An observation of the sun's surface the following day showed that a new group of sun-spots with facula was on the edge of the limb appearing by rotation.

February 15th, 1893.—First observation taken at 7.45 P. M. when aurora was present; it consisted of a fine arch about 15° in altitude with a dark segment, which at 8 P. M. became double; small dark clouds were observed above these dark segment arches. At 8.15 P. M. the dark segment was much deeper in color but had diminished to a low flat appearance about 5 to 7° in height, from which several streamers shot up to a height of about 30° and of a light green color. At 8. 30 P. M. the dark segment was lighter in color and the arch higher and brighter but no streamers were noted. At 9.30 P. M. the arch was somewhat higher and the entire northern sky of a pale diffuse light. At 10 P. M. long pale streamers from various directions reached to an altitude of about 30,° with a westward movement, followed by orange and red, changing to lilac, purple and deep garnet beams in the northwest. Many other beautiful effects were noticed until about midnight after which time the meteor became quiescent, and remained visible until 6 A. M. of the 16th. As with the aurora of the 4th inst. a new group of sun-spots and faculæ disturbances were on the sun's limb appearing by solar rotation.

DAVID E. HADDEN.

FEBRUARY WEATHER REPORT.

The month of February, 1893, following two unusually cold months, completed the record of one of the coldest winters ever experienced in Iowa. There have been but two colder Februarys within the past twenty-five years, viz., in 1875 and 1885. The mean temperature of the month, 16.4°, was about 7° below the normal.

The average precipitation for the State, 1.39 inches, was but little below the normal for the month. There were two severe storm periods, viz., on the 6th and 7th, and on the 26th, 27th and 28th. The notable feature of the latter period was the quite general electric storm of the 27th, which is described in the observers' notes. It was a heavy storm of snow and sleet, with temperature below freezing, accompanied by vivid lightning and heavy thunder. At Boone at the hour of 4:30 A. M., the residence of E. H. Burlingame was struck by lightning and nearly demolished.

The following table gives, as a basis of comparison, the mean temperature and total precipitation of the month of February, at the stations named, for the years from 1872 to 1893, inclusive.

YEARS.	MEAN TEMPERATURE, DEGREES.						PRECIPITATION, INCHES.					
	Des Moines.	Davenport.	Dubuque.	Keokuk.	Omaha.	Sioux City.	Des Moines.	Davenport.	Dubuque.	Keokuk.	Omaha.	Sioux City.
1872	....	27	....	29.7	28	....	.....	0.10	.....	0.39	0.43	.....
1873	....	24	....	25.0	27	....	.....	0.77	....	0 53	0.04	.....
1874	....	26	23	28.9	23	....	.....	0.74	.36	0 88	0.92	.....
1875	....	10	6	18.0	13	....	.. ..	1.09	2.12	1.84	0.51	.....
1876	....	30	28	34.9	30	....	.....	3.63	1.53	1.45	0.40	.....
1877	....	36	35	38.4	37	....	.....	0.07	.26	0.15	0.44	.....
1878	....	37	35	38.6	37	....	.....	1.09	1.93	2.95	0.14	.....
1879	25	26	23	28.8	27	....	1.90	1.09	1.00	0.53	0.93	.....
1880	32	34	29	36.4	31	....	0.17	1.72	1.01	1.94	0.14	....
1881	20	20	20	24.8	18	....	2.68	4.14	3.70	2 58	3.09	....
1882	36	40	36	40.2	36	....	1.21	0.62	.59	1.54	0.60	.....
1883	19	24	19	24 9	22	....	2.51	4.42	2.60	6.13	1.09	.....
1884	22	27	22	27.8	19	....	1.02	0.98	2.19	1.88	1.42	.....
1885	15	17	13	17.0	17	....	0.42	1.20	.72	1.14	0.47	.....
1886	25	23	22	27.1	24	....	0.52	1.52	1.36	1.40	0.36	.....
1887	19	24	21	30.4	18	....	1.65	4.87	3.56	5.19	1 00	.....
1888	23	21	19	26.2	26	....	1.51	1.17	1.3	2.17	0.74	.....
1889	20	19	16	24.6	23	....	0.27	1.44	1.34	0.90	0.23	....
1890	22	31	27	32.8	25	22 9	1.17	1.10	1.25	1.09	0.54	.40
1891	23	26	23	29.2	20	13.4	1.13	0 89	.98	1.32	1.02	1.26
1892	29	31	29	33.5	30	24.7	1.35	1.38	1.02	1.61	0.54	.97
1893	17	17	15	21.3	20	15 2	1.28	1.69	1.30	1.76	0.97	.77
Means	23.1	25	23	28.1	26	19.0	1 33	1.67	1.59	1.83	0.77	.85

SUMMARY OF WEATHER CONDITIONS.

BAROMETER.—Mean pressure for the month, 30.18 inches. Highest observed, 31.04, at Cresco, on the 3d. Lowest observed, 29.37 at Cresco, on the 27th. Range for the State, 1.67 inches.

TEMPERATURE.—Monthly mean, 16.4; highest monthly mean, 22.1, at Glenwood; lowest monthly mean, 8.8, at Eagle Grove. The highest temperature reported was 60, on the 19th, at Glenwood. The lowest temperature reported was -28, at Charles City, on the 4th.

Average daily maximum, 26.8; average daily minimum, 5.6; average monthly maximum, 43.0; average monthly minimum, 19.2. Greatest monthly local range, 78, at Glenwood. Least monthly local range, 56, at Keosauqua. Range for the entire State, 88. Average monthly range, 62.3.

PRECIPITATION.—Average for the State, 1.39 inches. The greatest amount reported, 2.91, at Hampton; least amount reported, .06, at Glenwood. Average number of days on which .01 inch or more fell, 6.2.

MISCELLANEOUS.—Average number of cloudy days, 9.7; partly cloudy, 8.2; cloudless, 10.1.

Auroras at Newton, 15th; Monticello, 15th; Alta, 4th, 15th, 16th; Ames, 4th, 15th; Panama, 4th, 15th.

Thunder storms occurred quite generally throughout the State on the 27th.

Hail at Alta, 27th; Iowa City, 2d.

Solar Halo at Hopeville, 4th, 11th.

Lunar Halo at Hopeville, 20th, 24th.

Corona at Hopeville, 20th.

ATMOSPHERIC PRESSURE.

STATIONS.	Mean actual barometer.	Mean reduced barometer.	EXTREMES.			
			Highest barometer	Date.	Lowest barometer	Date.
Cedar Rapids	.....	30.20	31.04	3	29.37	27
Clarinda	.....	30.19	.....	...	.....	...
Cresco	.....	30.20	.....	...	.....	...
Davenport	.....	30.14	30.93	3	29.45	27
Des Moines	29.17	30.18	30.98	3	29.46	27
Dubuque	.....	30.15	30.96	3	29.43	27
Grinnell	.....	.....	.....	...	.....	...
Keokuk	29.47	30.14	30.94	7	29.44	27
Omaha, Neb	.....	30.21	31.01	3	29.71	27
Sioux City	.....	30.18	30.98	3	29.69	27
Mean	29.32	30.18	31.04	3	29.37	27

WIND MOVEMENT.

STATIONS.	Miles.	Maximum velocity.	Direction.	Date.
Davenport	8,705	44	SW	28
Des Moines	6,336	34	S	21
Dubuque	4,667	25	W	28
Keokuk	5,807	35	W	9
Lacrosse	5,118	32	W	28
Omaha	6,633	35	NW	9
Sioux City	8,978	42	S	8

OBSERVERS' NOTES.

Williams.—M. L. FULLER: A thunder-storm, with unusually frequent discharges of lightning, occurred on the 27th, from 4 to 8 A. M. The duration, frequency of discharge and heavy precipitation, made this a noteworthy storm, though no damage resulted. The storm was preceded by a light fall of fine, floury snow on the 26th. The thunder was first heard at 4 A. M. on the 27th, and the discharges continued at intervals of 3 to 6 minutes till 7:30 A. M. It was accompanied by a fall of dry pellets of snow and ice. Total precipitation, melted, 1.60 inches.

Osage.—G. D. PATTENGILL: On the 27th, from 7:10 to 7:30 A. M., there were brilliant discharges of lightning, followed by loud thunder, and during all the time snow was falling very fast in large flakes. The thermometer stood at about 20°. The only rainfall of the month occurred on that date, continuing from 11 A. M. to 6 P. M., followed by snow.

Algona.—C. D. PETTIBONE: On the morning of the 27th occurred an unusual electric storm, commencing at 5:30 and continuing until 10 A. M. The lightning was vivid and thunder heavy amid a terrific snow-storm. The snow coming down like rain in summer under like atmospheric conditions. Telegraphic instruments were useless for several hours.

Bonaparte.—HON. B. R VALE: The ground has been practically covered with snow or ice all the month. Winter grain on corn ground is still covered. In this locality the ground has been protected by snow or ice since November 17th.

Fayette.—R. Z. LATIMER: Summary of observations for February: Mean temperature for the month, 14°; mean maximum temperature for the month, 24°; mean minimum temperature for the month, 2°; maximum temperature, 38°, on the 27th; minimum temperature, 22° below, on the 4th. Nine days in the month temperature dropped below zero, and on the 1st, 3d, 6th and 7th, the temperature did not reach above zero. Total precipitation (including melted snow), 1.26 inches. Snow fall during the month, 9.45 inches. Depth of snow on the ground on the 15th, 14 inches. Depth of snow on the ground at the end of the month, 12 inches. Prevailing wind, northwest. Number of days clear, 13; partly cloudy, 3; cloudy, 12. Observation taken at 7 A. M. showed the temperature below zero nine times; at 1 P. M. four times and at 9 P. M. four times. One sharp flash of lightning and heavy peal of thunder during the snow storm on the morning of the 27th.

Clinton.—DR. LUKE ROBERTS: The rigorous winter weather which characterized the first decade of February, 1893, was a continuation of that which January had furnished, and was equal in mean temperature, and phenomenally unstable.

Monticello.—HENRY D. SMITH: The maximum temperature for February, since 1854, was 60°, in 1877; minimum, 32° below zero, in 1875. The highest mean temperature of the month was 34.6°, in 1878; lowest mean, 7.5°, in 1875; normal for the month, 21.42°. Maximum precipitation for the month, since 1854, was 4.22, inches, in 1857; minimum, 0.32, in 1877; normal for the month, 1.92. Greatest depth of snow, 15.8 inches, in 1874; least, 0.25, in 1869. Our cold winters since 1854 were 1859–60, when the mean temperature for December, January and February, was 13.03°; in 1863–4, with a mean of 13.23°; in 1874–5, with a mean of 10.83°, in 1884–5, with a mean of 10.11°; and in 1892–3, with a mean for the three winter months of 12.43°. The normal temperature for the winter months is 19.18°; the mean the past winter being nearly 7° below the normal. There were in December 10 days, in January 20 days, and in February 9 days, in which the thermometer touched zero or below.

The following table will show its ups and downs on alternate days:

DAY OF MONTH.	Temperature, degrees.
First	-1.
Second	16.
Third	-5.5
Fourth	5.7
Fifth	30.8
Sixth	1.
Seventh	-10.
Eighth	7.5
Ninth	30.5
Tenth	12.5

The highest temperature for February was 40 degrees, the same as for January. The lowest was 16 below zero, occurring on the 4th and also on the 8th. The mean temperature for the month was 17.4°. This was 4.9° below a mean of the last 15 Februarys. It was also the coldest February, save two, for this period, viz: February, 1883,

was 15.6°, and February, 1885, was 8.3° — 9.1° colder than the last month.

SEASON COMPARISONS FOR THE WINTER MONTHS—DECEMBER, JANUARY AND FEBRUARY.

YEARS.	NO. OF STORM DAYS. Rain.	Snow.	Total.	Depth of snow in inches.	Total precipitation snow being melted.	Temperature in degrees.
1879-80	14	7	21	2	5.32	29.2
1880-81	7	22	29	31	7.61	15.1
1881-82	17	11	28	9	4.02	29.5
1882-83	9	23	32	31	8.03	15.0
1883-84	9	19	28	33	4.48	18.6
1884-85	10	25	35	45	7.70	12.2
1885-86	12	26	38	47	8.79	10.5
1886-87	12	20	32	28	7.65	16.8
1887-88	20	16	36	34	6.87	17.0
1888-89	10	12	22	21	6.47	24.2
1889-90	18	8	26	12	5.67	31.0
1890-91	10	7	17	10	6.28	26.3
1891-92	9	9	18	17	5.76	26.2
1892-93	8	17	25	37	7.00	14.5
Sums	165	222	387	357	91.66	295.1
Means	12	15	27	25.5	6.55	21.1

By the above table it will be seen that the coldest winter was that of 1884-5, a mean of 8.9 degrees below that of the winter just closed. Seven other winters were colder than 1892-93, which will be seen by the table.

The depth of snow fall for the last winter was 37 inches, 11.5 inches above a normal for the last fourteen winters. But two winters in the time given furnished more snow.

Good sleighing prevailed during the winter just closed, without a day's interruption.

This was not wholly due to the amount of snow, but rendered possible by the continuous cold and the snow fall occurring at frequent intervals.

Continuous sleighing for so great a number of consecutive days is without a parallel in Eastern Iowa, so far as I have information.

Roads were exceptionally good during these three months, and business was greatly benefitted thereby.

The maximum temperature for February, 1893, was lower than any of its predecessors for the fifteen years mentioned.

The coldest day of the month was the 7th, with a mean temperature of 10° below zero.

The warmest day was the 27th, with a mean temperature of 38.3°. The range of temperature for this day was only 8°, the least for the month.

The number or storm days was 8, all of which were light, only one reaching one-half inch. Total precipitation (snow melted), 1.68 inches; 12 inches was the depth of snow fall. On the 15th there was remaining on the ground 11 inches of snow, and at the close of the month, 10 inches.

There were seven clear days, 9 cloudy, and 12 fair. The per cent of cloudiness was 55. The wind largely prevailed from the west, and its total movement was 5,150 miles; a few miles above normal. The maximum velocity was 26 miles an hour.

SOLAR OBSERVATIONS, FEBRUARY, 1893—ALTA, IOWA.

BY DAVID E. HADDEN.

Date.	CENTRAL TIME.	NUMBER VISIBLE Groups.	Spots.	Faculæ.	Definition.	REMARKS.
3	11:30 A. M.	7	* 35	2	Fair...	Large group is near W. limb; all the groups are west of the meridian.
5	3:00 P. M.	3	....	.....	Bad....	Clouds. A new group with facula on edge of S. E. limb appearing by rotation.
6	11:45 A. M.	2	* 12	4	Fair...	Air very cold and unsteady. Large facula on limb disappearing by solar rotation. Small spot west. Other group S. E.
7	11:35 A. M.	5	37	6	Good..	New small group W. of group S. E., other new group near W. limb. Area of facula by rotation.
10	11:50 A. M.	5	53	3	Good..	Large group with numerous small spots near center. Train of 3 groups further east. One large spot with nucleus and penumbra.
11	11:45 A. M.	9	* 70	3	Good..	New large group on edge of E. limb by rotation. Two faint "veiled" groups, one in S. E. and the other in N. W. quadrants. The nucleus of the large spot S. E. has divided in two. Large group on meridian.
12	4:30 P. M.	5	....	2	Good..	Small group by rotation N. E.
15	12:00 M.	4	* 60	4	Fair...	Windy. Train of four large spots W. Six spots have umbra and penumbra. Groups facula by rotation N. E. and S. E. limbs. Beautiful aurora this evening.
16	11:30 A. M.	5	* 45	3	Good..	New group S. latitude, near equator on E. limb.
18	11:45 A. M.	6	25	5	Good..	Fairly large group on edge of E. limb by rotation. Extensive facula area near E. limb. Large group west of meridian is decreasing.
19	4:00 P. M.	5	25	4	Good..	New spots in group in E. limb.
21	5:20 P. M.	4	....	.....	Poor..	New group one day in S. E. Train of groups E.
23	11:40 A. M.	4	40	3	Fair...	Area of facula E. two days in. Two large trains of spots E. of meridian in high N. latitude.
25	11:40 A. M.	5	65	3	Good..	Two large and one small group N. W. Extensive faculæ on W. limb. Two groups of by rotation in, on N. E. limbs. Fine large spot E
28	5:10 P. M.	5	.....	3	Fair...	New group and prominent facula by rotation about one day in E. limb.

* About.

METEOROLOGICAL DATA FOR FEBRUARY, 1893.

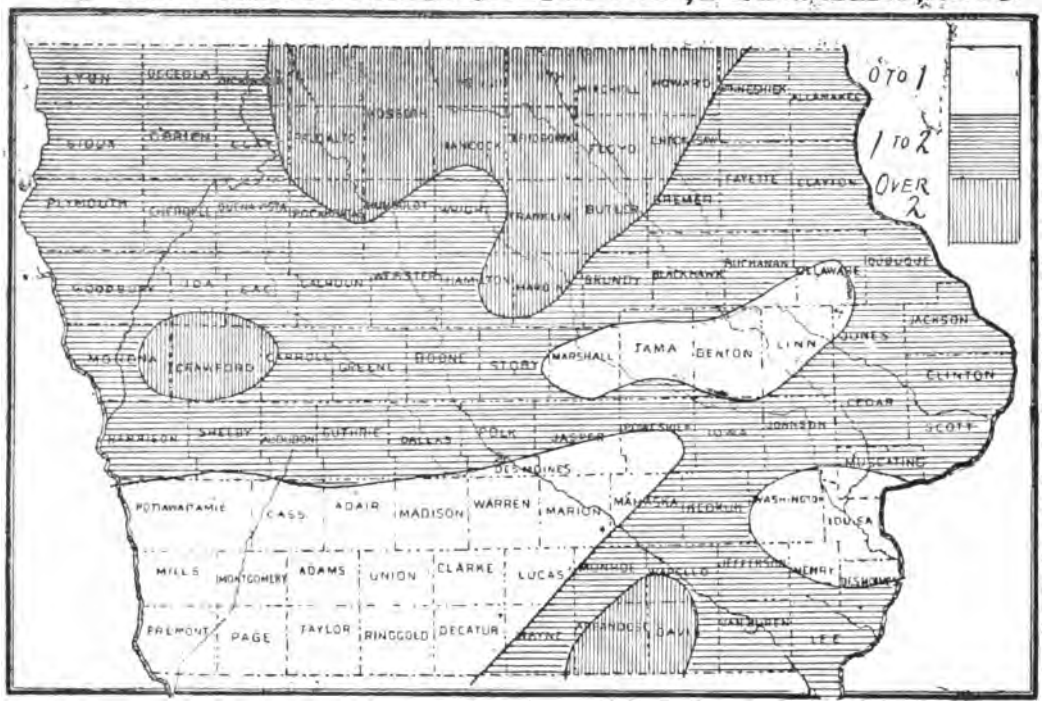
STATIONS.	TEMPERATURE OF THE AIR (IN DEGREES FAHRENHEIT).								PRECIPITATION IN INCHES.			Prevailing direction of wind.	No. of rainy days. (.01 inch or more).	No. of cloudy days.	No. of fair days.	No. of clear days.	No. of hail-storms.	No. of thunder-storms.
	Monthly mean.	EXTREMES.						Monthly range.	Monthly, including melted snow.	Total monthly snowfall.	Depth of unmelted snow at end of month.							
		Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.											
Algona	11.7	38	13	22.8	-24	1	1.2	62	2.04	.....	.....	NW	4	6	15	7	1	1
Alta	11.0	37	19	20.9	-22	1	1.1	59	1.32	.....	.....	NW	9	9	9	10	1	1
Ames (F. C. Stewart)	13.2	40	19	25.2	-24	4	1.6	64	1.88	.....	.....	NW	7	6	14	8	..	..
Ames (E. N. Eaton)	.....	.....	.....	.....	.....	.....	.....	.....	2.11	.....	.....	.....	6	.....	.....	.....	.....	.....
Amana	15.6	40	14	24.5	-17	4	6.6	57	1.35	.....	.....	NW	7	11	9	8	..	1
Atlantic	18.3	46	23	31.2	-21	4	5.4	67	1.22	.....	.....	NW	7	11	5	12	..	1
Audubon	15.3	40	13	26.2	-20	7	4.4	60	1.52	.....	.....	NW	3	10	9	9	..	1
Belle Plaine	14.8	41	5	24.6	-19	4	5.0	60	1.20	.....	.....	NW	5	17	3	8	..	1
Blakeville	14.0	.....	.....	.....	.....	.....	.....	.....	2.55	.....	.....	SE	7	13	8	7	..	1
Blockton	20.0	48	26	32.9	-15	5	7.0	63	.80	.....	.....	.....	2	.....	.....	.....	..	1
Bonaparte	20.9	44	27	31.2	-14	4	10.6	58	1.42	.....	.....	NW	6	.....	.....	.....	..	..
Carroll	18.1	40	7	28.5	-21	5	4.2	61	1.95	.....	.....	.....	6	3	11	14	..	1
Cedar Falls	14.6	38	12	29.1	-23	4	3.5	61	1.90	12.0	.....	NW	5	15	4	9	..	1
Cedar Rapids	17.4	42	27	25.0	-16	4	9.9	58	1.82	8.5	.....	.....	9	10	9	9	..	1
Centerville	21.2	46	27	33.0	-16	7	9.4	62	2.10	7.0	.....	W, SE	7	11	8	8	..	1
Charles City	10.4	40	13	20.0	-28	4	.8	68	2.28	14.5	.....	NW	8	.....	.....	.....	..	..
Clarinda	18.2	46	19	28.5	-15	1	7.8	61	1.12	8.0	.....	S	5	8	8	12	..	..
Clinton	16.7	40	27	27.6	-16	4	5.8	56	1.68	11 5	.....	W	9	10	11	7	..	..
College Springs	18.9	44	19	28.4	-17	7	9.4	61	1.89	13.0	.....	NW	5	12	0	16	..	1
Corning (J. W. Bixby)	18.3	49	19	29.0	-17	7	7.7	66	0.45	1.5	.....	NW	4	7	10	11	..	..
Cresco	9.3	44	13	19.5	-27	4	-1.0	71	1.23	6.	.....	.....	6	8	10	10	..	..
Davenport	17.4	42	27	25.2	-14	4	9.6	56	1.69	.....	.....	W	11	13	7	8	..	..
Decorah	11.9	48	13	27.4	-24	3	-3.6	72	1.30	.....	.....	.....	2	9	8	11	..	..
Delaware	11.4	*40	27	.....	*-23	4	.....	63	0.97	3.0	.....	NW	6	9	8	11	..	..
Denison	16.8	47	19	30.2	-19	1	3.3	66	2.45	24.5	.....	NW	6	7	13	8	..	..
Des Moines	17.4	45	27	26.9	-16	4	8.0	61	1.28	.....	.....	NW	10	6	13	9	..	..
Dubuque	15.0	40	27	23.6	-21	4	6.4	61	1.30	.....	.....	W	7	10	7	11	..	..
Eagle Grove	8.8	.....	.....	.....	.....	.....	.....	.....	1.40	14.0	.....	NW	5	.....	.....	.....	..	..
Elkader	12.5	41	13	24.2	-27	8	0.9	68	1.13	.....	.....	NW	5	6	8	14	..	1
Emmetsburg	10.1	40	13	21.9	-26	1	-1.7	76	2.50	.....	.....	.....	9	10	1	17	..	1
Fayette	13.0	38	27	24.0	-22	4	2.0	60	1.48	9.5	.....	NW	8	12	3	13	1	1
Ft. Madison	25.0	*48	29	.....	*-10	7	.....	58	1.39	12.5	.....	NW	4	16	5	7	..	1
Fulton	16.1	.....	.....	.....	.....	.....	.....	.....	1.05	6.0	.....	.....	.....	.....	.....	.....	..	..
Galva	14.4	39	13	26.5	-20	1	2.6	59	0.70	7.0	.....	.....	5	12	5	10	..	..
Glenwood	22.1	60	19	33.8	-18	7	10.4	78	0.06	.....	.....	NW	4	8	9	11	..	..
Grand Meadow	*14.4	40	13	.....	-24	4	.....	64	1.76	9.5	.....	.....	6	.....	.....	.....	..	..
Greenfield	16.0	43	5	27.6	-21	7	4.3	64	1.37	8.4	.....	NW	11	8	8	12	..	2
Grinnell	17.9	40	27	26.3	-17	4	9.5	57	0.82	1.8	.....	.....	3	9	12	7	..	..
Grundy Center	12.1	40	27	23.4	-22	3	0.7	62	1.12	7.0	.....	NW	6	9	8	11	..	1
Hampton	10.9	36	5	20.8	-23	4	1.1	59	2.01	15.5	.....	NW	9	3	17	8	..	1
Hopeville	18.5	46	27	.....	-16	6	.....	62	0.50	4.0	.....	NW	6	10	10	8	..	..
Hopkinton	18.9	42	27	.....	-17	4	.....	59	1.35	6.0	.....	.....	10	.....	11	.....	..	..
Independence	13.3	40	28	24.3	-23	4	2.3	63	1.64	9.5	.....	W	8	8	9	11	1	1
Indianola	18.8	45	27	28.7	-17	1	8.8	62	0.90	2.0	.....	.....	5	11	10	7	..	..
Iowa City	18.6	41	28	30.1	-18	8	7.2	59	1.75	.....	.....	NW	5	13	.....	15	1	..
Jefferson	16.8	40	6	29.8	-22	1	3.8	62	1.20	11.0	.....	NW	4	5	14	9	1	1
Keokuk	21.3	49	26	30.2	-12	4	12.4	61	1 76	....	.....	W	9	10	8	10	..	..
Keosauqua	22.0	45	19	32.5	-11	4	11.4	56	1.44	9.0	.....	.....	5	.....	.....	.....	..	1
La Crosse, Wis.	14.0	43	13	23.7	-26	4	4.1	69	1.74	9.2	.....	W	9	11	9	8	..	..
Larrabee	12.7	40	20	24.9	-23	7	5.0	63	0.79	8.5	.....	NW	9	15	7	6	..	..
Logan	17.4	49	19	27.3	-16	1	7.6	65	1.50	.....	.....	S	4	13	5	10	..	..
Maquoketa	16.0	.....	.....	.....	.....	.....	.....	.....	1.72	6.0	.....	.....	6	.....	.....	.....	..	..
Marshalltown	17.4	44	28	27.5	-17	1	7.4	61	0.62	3.8	.....	N	6	8	5	15	..	..
Maxon	17.5	.....	.....	.....	.....	.....	.....	.....	1.00	.....	.....	.....	4	5	16	7	..	1
Monticello	*14.6	46	13	23.2	-20	7	4.8	66	1.32	4.2	.....	NW	6	8	10	10	..	..
Mt. Vernon	17.4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	..	..
Murray	18.4	47	27	28.7	-16	7	8.0	63	0.60	3.8	.....	S	8	15	.....	13	..	..
Newton	16.9	41	5	28.1	-19	4	5.8	60	1.00	6.8	.....	.....	8	13	3	12	..	..
Omaha, Neb.	20.0	52	19	28.2	-16	7	10.9	68	0.97	.....	.....	N	9	5	12	11	..	..
Osage	9.7	.....	.....	.....	.....	.....	.....	.....	2.33	14.8	.....	NW	8	14	4	10	..	..
Oskaloosa	18.7	42	5	28.6	-16	4	8.7	58	1.12	2.2	.....	.....	6	15	3	10	..	..
Panama	15.9	42	19	26.1	-18	7	5.6	60	1.16	10.9	.....	NW	5	6	5	11	..	..
Richland	18.2	.....	.....	.....	.....	.....	.....	.....	1.15	1.8	.....	.....	5	12	15	7	..	..
Sac City	11.3	40	20	19.9	-21	1	2.8	61	1.20	16.0	.....	NW	2	12	6	10	..	..
Sioux City	15.2	45	23	24.5	-21	1	4.8	66	.77	.....	.....	N	10	9	9	10	..	1
Storm Lake	13 9	39	12	24.9	-21	1	2.8	60	1.48	15.7	.....	NW	7	6	12	10	..	1
Tipton	16.8	40	14	27.4	-18	4	6.1	58	2.30	2.2	.....	W	11	8	10	11	..	1
Villisca	21.5	55	20	33.9	-16	7	9.1	71	0.21	2.1	.....	.....	3	.....	.....	.....	..	..
Vinton	15.9	*37	5	.....	*-17	4	.....	51	0.49	1.5	.....	NW	2	9	9	10	..	..
Washington	20.6	*48	19	28.9	*-15	4	12.4	63	0.30	.....	.....	W	2	.....	.....	.....	..	..
Webster City	18.3	.....	.....	.....	.....	.....	.....	.....	1.79	7.4	.....	NW	4	8	10	10	..	..
Williams	12.5	39	13	.....	-24	1	.....	63	2.20	9.1	.....	NW	7	7	12	9	..	..
Winterset	17.4	*44	5	26.5	*-18	7	8.3	62	0.94	4.5	.....	S W	6	14	4	10	..	..
Means	16.0	43	.....	26.8	-19.2	.....	5.6	62.3	1.39	8.1	.....	NW	6.2	9.7	8.2	10.1	..	..

*Taken from observed readings; all others from self-registering instruments.

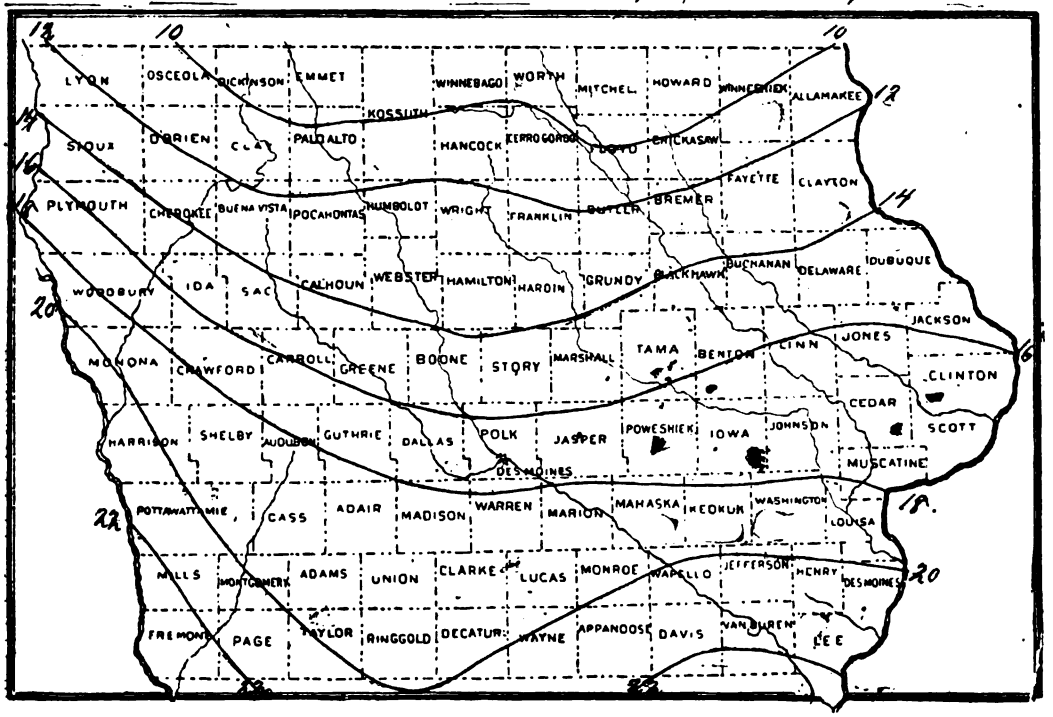
DAILY AND MONTHLY MEAN TEMPERATURE FOR FEBRUARY, 1893.

STATIONS.	DATE.																													Monthly Mean.
	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	
Algona	-18	2	-17	-2	8	-13	-10	11	20	9	12	25	30	8	14	15	24	20	25	24	16	21	24	18	17	16	14	14		11.7
Alta	-18	1	-14	-6	12	-14	-12	8	20	9	13	27	28	3	10	14	19	20	30	21	17	18	26	20	20	13	12	12		11.0
Ames (F. C. Stewart)	-12	2	-9	-17	13	9	-12	0	23	16	7	22	24	24	8	18	20	20	30	20	26	16	24	24	20	18	27	18		13 4
Amana	-8	9	-8	-2	26	-7	-8	0	25	16	8	26	27	26	10	18	22	20	30	18	26	18	27	23	20	19	35	23		15 6
Atlantic	-8	8	-7	4	25	20	-6	5	16	16	10	36	32	22	12	20	26	30	38	28	24	20	34	28	28	30	22	20		18.3
Audubon	-12	4	-10	3	20	-6	-10	6	20	12	12	25	30	20	12	20	24	25	35	24	24	25	29	26	24	25	16	16		15.3
Belle Plaine	-11	10	-10	-5	24	-8	-8	2	24	14	8	24	28	22	8	12	21	19	28	18	24	18	26	26	20	20	32	22		14.8
Blakeville	-6	2	-12	2	20	-6	-9	8	26	14	13	24	29	13	10	18	23	24	36	22	23	15	24	21	17	16	22	21		14.3
Blockton	4	2	-2	7	16	7	-5	8	22	16	21	25	32	25	20	22	27	28	37	28	28	22	26	34	28	31	30	23		20.0
Bonaparte	-1	10	-1	3	29	14	-4	6	26	24	24	26	28	28	17	30	24	24	32	20	26	21	27	29	25	30	38	30		20.9
Carroll					-10	-14	21	11	20	12	15	24	29	10	14	18	25	25	28	27	25	24	24	29	24	22	13	15		18.1
Cedar Falls	-6	2	0	-2	28	3	-6	4	-2	20	0	10	26	24	34	9	20	22	18	17	24	17	14	24	22	18	23	32	17	14.6
Cedar Rapids	-6	14	-2	0	24	15	-6	4	24	18	11	26	31	38	13	18	23	20	30	22	25	15	24	28	22	23	36	20		17.4
Centerville	4	4	1	2	27	14	-6	10	25	21	16	31	32	27	20	25	26	25	33	24	27	21	30	28	27	30	39	29		21.2
Charles City	-18	3	-10	-11	24	-10	-12	-1	24	15	1	24	29	16	2	18	20	13	27	16	2	12	24	16	10	12	23	21		10.4
Clarinda	-12	2	-6	8	23	-6	-5	10	22	16	16	26	33	20	13	22	22	28	36	28	24	23	33	27	28	34	20	22		18.2
Clinton	4	11	2	0	24	12	-9	9	24	19	6	18	34	28	11	18	20	20	26	13	25	22	26	26	16	20	36	28		16.7
College Springs	-12	2	-6	8	33	-7	-7	12	28	15	18	26	34	12	10	22	27	33	36	30	33	31	34	26	34	28	21	18		18.9
Corning (J. W. Bixby)	-8	-1	-5	3	25	-3	-6	10	23	16	12	28	30	21	12	22	25	28	40	26	26	20	37	30	28	31	23	21		18.3
Cresco	-17	4	-17	-7	18	-12	-12	2	24	10	8	26	29	17	7	16	19	14	23	13	21	17	23	18	15	10	30	16		14.4
Davenport	-2	12	-4	0	26	0	-8	4	24	18	11	23	28	29	12	32	21	20	29	16	26	20	28	28	18	24	38	24		17.4
Decorah	2	2	-8	-1	13	-9	8	11	8	12	12	24	20	9	6	14	17	14	20	22	20	16	24	19	8	19	14	21		11.9
Delaware	-10	6	-15	-10	24	-8	-2	4	24	12	-2	19	23	25	3	14	19	14	24	16	29	14	25	23	7	12	35	18		11.4
Denison	-17	2	-1	4	20	4	-2	9	22	15	13	21	36	19	15	32	26		31	26	33	32	30	28	26		20			16.6
Des Moines	-11	0	-7	-2	24	-8	-6	6	26	16	12	28	30	24	14	23	25	25	34	24	28	20	30	26	24	26	33	22		17.4
Dubuque	-6	6	-6	-6	22	-2	-10	-1	22	21	12	21	29	30	11	16	18	20	28	12	24	21	26	24	15	15	32	22		15 0
Eagle Grove	-20	-4	-16	-7	10	-16	-17	-6	21	5	6	18	26	14	4	12	18	19	28	17	20	13	24	19	17	16	14	12		8.8
Elkader	-7	0	-8	-9	19	-5	-8	-6	20	16	8	18	32	25	7	11	18	18	26	10	24	18	27	25	16	12	32	23		12.5
Emmetsburg	-21	-20	-17	-10	14	-15	-16	5	23	10	9	24	26	15	12	14	16	20	26	20	20	18	23	18	17	12	12	12		10.1
Fayette	-10	2	-4	-6	23	4	-10	-2	21	15	8	20	29	22	6	18	18	17	26	10	24	14	24	26	12	12	30	20		13.0
Ft. Madison	1	21	4	11	34	4	2	14	38	21	24	32	36	32	23	32	30	26	31	24	29	28	33	34	28	37	42	28		25.0
Fulton	-3	16	-7	6	31	-4	-8	4	22	15	4	17	26	26	10	18	23	19	26	14	24	22	28	24	23	19	14	14		14.4
Galva	-14	0	-10	0	19	-8	-8	8	12	14	28	30	17	13	16	25	24	31	24	26	30	28	24	23	19	14	28	22		14.4
Glenwood	-12	9	-7	7	25	-9	-6	12	26	20	19	34	33	24	16	29	29	36	47	31	35	30	39	34	29	34	25	28		22 1
Grand Meadow	-13	6	-14	-4	28	-9	-11	6	24	15	10	26	32	26	12	15	21	16	24	14	24	22	26	21	13	18	34	20		14.4
Greenfield	-10	0	-12	2	24	-4	-10	8	12	16	17	26	30	19	11	20	24	24	34	24	32	20	27	26	24	28	24	20		16.0
Grinnell	-6			4	32	4	-8	6	22	18	12	26	28	24	12	19	21	22	32	26	24	19	27	24	20	32	24	24		17.9
Grundy Center	-10	2	-15	-4	12	-14	-10	4	26	12	9	25	25	14	9	18	21	20	20	18	15	16	25	19	16	19	24	20		12.1
Hampton	-18	4	-16	-8	19	-13	-11	2	22	6	8	26	24	17	8	16	17	18	27	15	18	14	20	19	14	15	25	16		10.9
Hopeville	-10	2	-10	9	23	-12	-6	14	21	14	19	26	35	17	17	23	27	29	33	28	24	24	33	27	26	30	28	27		18.5
Hopkinton	-8	13	-3	2	32	-3	-5	8	31	20	16	27	34	30	13	20	22	21	31	18	26	24	28	26	20	21	38	26		18.9
Independence	-8	0	-10	-8	20	-4	-10	-1	21	20	11	20	24	24	7	16	18	18	27	16	23	16	24	22	15	14	30	26		13.3
Indianola	-4	-1		-1	25	9	-8	8	26	20	13	28	32	26	14	21	23	24	34	27	27	22	29	23	25	26	35	22		18.8
Iowa City	12	8	3	3	24	16	-6	-2	23	24	12	24	28	28	12	19	22	22	31	22	26	18	27	26	20	21	34	28		18.6
Jefferson	4	-2	-2	-5	22	12	-12	5	26	20	17	32	37	26	9	18	24	22	32	32	30	16	25	27	24	21	25	15		16.8
Keokuk	-6	10	3	4	21	-2	-4	10	28	20	17	22	31	35	20	26	24	25	35	24	25	23	30	29	26	32	38	30		21.3
Keosauqua	13	6	5	2	26	16	-1	6	24	24	16	27	29	30	20	26	24	25	35	24	25	23	30	29	26	32	38	30		22.0
Larrabee	-13	0	-5	-6	16	-10	-12	8	22	9	12	26	30	15	12	14	21	23	30	24	16	20	26	20	18	14	14	14		12 7
Logan	-12	2	-10	6	21	-6	-6	10	26	18	14	22	32	8	19	25	28	30	34	25	32	22	27	30	28	18	14	17		17.4
La Crosse, Wis	-12	1	-9	-8	16	-5	-8	0	21	20	15	24	32	29	11	20	17	21	27	12	24	22	27	24	14	9	30	21		14.0
Maquoketa	-6	15	5	3	30	-4	-9	8	22	16	4	18	30	25	12	10	17	18	26	16	21	20	24	24	17	25	37	22		16.0
Marshalltown	6	0	2	-7	16	13	-5	5	23	20	10	24	26	28	10	20	22	22	30	26	27	18	25	28	18	22	32	28		17.4
Maxon	-12	3	-11	12	32	-10	-7	13	23	12	18	28	34	18	16	20	24	25	30	22	23	22	30	24	22	30	28	24		17.5
Monticello	-9	3	-14	8	28	-8	-14	4	26	10	7	18	31	24	8	18	22	16	37	16	23	23	26	23	14	19	36	22		14.6
Mt. Vernon	-6	11	-12	6	34	-8	-12	8	25	12	15	25	34	24	9	23	24	18	30	22	23	23	28	23	18	27	36	23		17.4
Murray	-6	0	-9	7	26	-8	-7	10	22	16	16	26	30	24	15	23	24	26	26	24	28	20	28	26	22	32	32	22		18.4
Newton	-4	0	-4	-4	24	12	-10	4	24	19	10	26	28	25	12	21	22	22	26	22	24	19	27	26	22	22	32	26		16.9
Omaha, Neb	-12	4	-9	8	20	-10	0	14	24	18	20	30	35	9	20	25	28	36	4	31	28	27	36	28	22	16	22	20		20.0
Osage	-18	4	-16	-10	13	-13	-12	0	24	8	4	23	28	19	2	8	16	13	24	16	22	12	23	18	7	10	28	14		9.7
Oskaloosa	-4	4	-2	-2	26	10	-6	4	26	18	20	29	29	24	12	20	24	24	33	22	26	21	32	28	23	22	14	18		15.9
Panama	-12	4	-8	4	18	-7	-8	8	20	14	13	24	30	20	12	20	24	28	36	26	26	21	32	28	23	22	32	24		18.7
Richland	4	6	-10	3	34	-10	-9	11	27	15	12	28	30	21	14	25	24	24	31	21	21	24	27	26	23	31	32	25		18.2
Sac City	-16	2	-13	-4	16	-12	-12	-7	0	-2	13	28	26	10	15	18	20	24	34	25	28	22	32	22	20	12	15	11		11.3
Sioux City	-14	2	-12	1	12	-12	-7	10	20	14	14	30	34	8	16	20	25	20	28	29	24	25	34	24	22	18	12	18		15.2
Storm Lake	-12	-4	-8	-2	18	-6	-10	6	22	12	12	27	26	19	12	16	20	22	32	24	25	19	32	26	22	20	14	18		13.8
Tipton	-4	11	-2	-2	24	14	-6	2	26	22	12	25	27	25	11	24	20	20	32	16	26		19	26	20	20	36	27		16.8
Villisca	11	0	6	1	14	14	3	0	18	22	20	20	33	30	12	20	30	28	32	42	36	23	31	36	28	35	34	23		21.5
Vinton	-9	2	-12	2	25	-8	-10	9	26	11	13	25	31	17	12	21	24	22	28	18	22	20	29	23	17	22	33	25		15.9
Washington	-7	16	-2	-6	36	-3	-4	9	30	22	16	31	31	30	16	22	26	23	38	22	30	24	31	30	26	28	39	25		20.6
Webster City	-15	2	-10	-2	12	-11	-10	13	22	10	5	27	30	13	12	17	25	24	28	24	18	18	22	24	18	19	18	15		13.3
Williams	-18	-1	-17	-1	12	-12	-12	12	22	6	16	24	31	12	11	16	22	24	25	20	18	19	26	20	20	17	20	16		12.5
Winterset	-14	0	-6	2	28	-10	-8	8	20	16	14	28	32	24	13	22	24	24	36	24	25	20	28	26	26	28	28	20		17.4

IOWA PRECIPITATION CHART, FEBRUARY, 1893



MEAN TEMPERATURE, FEBRUARY, 1893.



DAILY AND MONTHLY PRECIPITATION FOR FEBRUARY, 1893.

STATIONS.	DATE. 1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th	27th.	28th.	Total.
Algona	....	0.25	....	....	T	....	....	....	0.21	....	....	....	T	....	....	....	0.04	....	....	T	....	....	....	T	....	....	1.55	....	2.04
Alta	....	0.19	....	....	T	0.05	....	....	0.07	....	....	....	....	0.08	....	....	0.03	....	....	T	T	....	....	T	0.05	0.25	0.60	....	1.32
Ames (F. C. Stewart)	....	0.11	....	....	0.02	....	....	....	0.03	....	....	....	....	0.10	....	....	T	....	....	....	T	....	....	....	0.02	0.14	1.46	....	1.88
Ames (E. N. Eaton)	....	0.36	....	....	....	0.02	....	....	0.03	....	....	....	....	0.10	....	....	....	....	....	....	....	....	....	....	T	0.14	1.46	....	2.11
Amana	....	0.23	....	....	....	0.41	....	....	0.06	0.02	....	....	....	0.19	....	....	T	....	....	....	T	....	T	....	....	....	0.13	0.31	1.35
Atlantic	....	0.10	0.25	....	....	0.10	....	0.05	....	....	....	....	....	0.12	....	....	....	....	....	....	....	....	....	....	....	0.25	0.35	....	1.22
Audubon	....	0.38	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.54	0.60	....	1.52
Belle Plaine	....	0.20	....	....	....	0.30	....	....	0.10	....	....	....	....	0.19	....	....	T	....	....	....	T	....	T	T	T	T	0.41	T	1.20
Blakeville	0.45	....	....	....	....	0.15	....	....	0.20	....	....	....	....	0.50	T	....	....	....	....	T	T	....	0.10	....	....	0.15	1.00	....	2.55
Blockton	....	....	....	....	....	....	....	....	....	....	0.50	....	0.30	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.80
Bonaparte	0.20	....	....	....	0.25	....	....	....	....	....	....	....	0.25	0.02	....	....	0.45	....	....	....	....	....	....	....	....	....	0.25	....	1.42
Carroll	....	0.40	....	....	....	0.05	....	....	T	0.05	....	....	1.02	....	....	....	....	....	....	....	....	....	....	T	....	0.72	0.75	....	2.99
Cedar Falls	....	0.40	....	....	....	0.30	....	0.20	....	....	....	....	....	....	....	....	....	....	....	....	T	....	....	....	....	0.30	0.70	....	1.90
Cedar Rapids	0.12	0.01	0.02	....	....	0.25	0.32	....	0.02	0.15	....	....	....	0.14	0.04	....	....	T	....	....	T	T	....	0.03	....	....	0.12	0.60	1.82
Centerville	0.20	0.20	....	....	T	0.20	....	....	0.10	....	T	....	....	1.00	....	....	0.10	....	....	....	T	T	....	....	....	....	0.30	....	2.10
Charles City	....	0.40	0.10	....	....	....	....	0.10	....	....	....	....	....	....	....	....	0.05	....	....	....	....	....	....	....	....	0.15	1.38	....	2.18
Clarinda	0.25	....	....	....	....	0.05	....	....	....	....	0.28	....	....	0.24	....	....	....	....	....	T	....	....	....	....	....	0.00	0.30	....	1.12
Clinton	0.07	0.30	....	....	0.50	0.03	....	....	0.13	....	....	....	....	0.22	....	....	....	....	0.24	....	0 01	....	....	....	....	....	0.18	....	1.68
College Springs	....	0.20	....	....	....	0.15	....	....	....	0.95	....	0.26	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.33	....	1.89
Corning (J. W. Bixby)	....	....	....	....	0.05	....	....	T	0.05	0.05	....	....	....	....	....	....	....	....	....	....	T	....	....	T	....	T	0.30	....	0.45
Cresco	....	0.06	....	....	....	0.07	....	....	0.15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.15	0.75	0.05	1.23
Davenport	0.15	0.30	....	....	T	0.46	....	....	0.08	0.02	....	....	....	0.25	T	....	0.24	T	....	....	0.03	....	....	T	0.02	....	0.12	0.02	1.69
Decorah	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.70	....	....	....	....	....	....	....	0.60	....	....	1.30
Delaware	....	0.07	....	....	....	0.04	....	....	0.06	....	....	....	....	0.13	....	....	....	....	....	....	....	....	....	....	....	....	0.62	0.05	0.97
Denison	0.15	....	....	....	0.40	....	....	T	....	....	....	....	0.30	....	....	....	T	....	....	....	T	....	....	T	....	0.50	1.10	....	2.45
Des Moines	T	0.12	....	....	....	0.16	....	T	0.06	0.02	T	T	....	0.21	....	....	0.02	T	....	....	0.01	....	....	T	T	0.09	0.49	0.10	1.28
Dubuque	....	0.20	....	....	....	0.23	....	....	0.18	0.02	....	....	....	0.06	....	....	....	....	....	....	....	....	....	....	....	....	0.41	0 20	1.30
Eagle Grove	0.20	0.10	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	T	0.10	....	0.30	0.70	....	1.40
Elkader	....	0.14	....	....	....	0.10	....	....	0.18	....	....	....	....	0.07	....	....	....	....	....	....	T	....	....	....	....	....	0.64	....	1.13
Emmetsburg	....	0.20	....	....	....	0.10	....	....	0.20	....	....	....	0.05	0.20	....	....	....	....	....	....	....	....	....	0.05	....	0.30	1.20	0.20	2.50
Fayette	....	0.33	....	....	....	0.10	....	0.12	0.02	....	....	....	....	0.17	....	....	....	....	....	T	T	....	T	T	....	0.02	0.72	....	1.48
Ft. Madison	0.25	....	....	....	....	T	....	....	....	....	....	....	....	0.30	....	....	0.60	....	....	....	T	....	....	....	....	....	0.24	....	1.29
Fulton	....	....	....	....	....	0.40	....	....	....	....	....	....	....	0 60	....	....	....	....	....	....	....	....	....	....	0 05	....	....	....	1.05
Galva	....	0.15	....	....	T	T	....	T	T	....	....	....	0.10	T	....	....	T	....	....	....	T	....	....	T	0.15	0.10	0.20	....	0.70
Glenwood	....	0.06	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0 06
Grand Meadow	....	0.30	....	....	....	0.20	....	....	0.30	....	....	....	....	0.15	....	....	....	....	....	....	....	....	....	....	....	0.06	0.75	....	1.76
Greenfield	0.02	0.23	....	....	....	0.06	....	0.11	0.04	....	0.03	....	0.01	0.22	....	....	T	....	....	T	T	....	....	T	T	0.12	0.50	0.03	1.37
Grinnell	T	....	....	....	....	0.40	....	T	....	0.20	....	....	....	0.10	....	....	T	....	....	....	....	....	....	....	T	0.12	T	....	0.82
Grundy Center	....	0.20	....	....	0.10	....	....	....	0.06	....	....	....	0.10	T	....	....	T	....	....	....	....	....	....	....	....	0.36	0.30	....	1.12
Hampton	....	0.34	....	....	....	0.05	....	0.10	0.08	....	....	....	0.13	....	....	....	0.06	....	....	....	....	....	....	....	....	0.10	1.94	0.10	2.90
Hopeville	T	0.11	....	....	....	0.18	....	0.02	....	....	0.08	T	T	....	....	....	....	....	....	....	0.01	....	....	T	....	....	0.10	....	0.50
Hopkinton	....	0.10	....	....	....	0.20	....	....	0.20	....	....	....	....	0.40	....	....	T	....	....	....	T	T	....	....	....	....	0.45	....	1.35
Independence	....	0 27	....	....	....	0.15	....	....	0.30	....	....	....	....	0 20	....	....	0.02	....	....	....	....	0.02	....	....	....	....	0.50	0.18	1.64
Indianola	....	0.10	....	....	....	....	....	....	....	0.33	0.01	....	....	....	0.13	....	....	....	....	....	....	....	....	....	....	....	T	0.33	0.90
Iowa City	....	0.40	....	....	....	0.40	....	....	0.05	....	....	....	....	0.30	....	....	T	....	....	....	....	....	....	....	....	....	0.60	....	1.75
Jefferson	....	0.30	....	....	....	....	....	....	T	....	....	....	....	....	....	0 10	....	....	....	....	T	....	....	....	....	0 25	0.55	....	1.20
Keokuk	0.28	0.12	....	....	0.01	0.21	....	....	0.04	....	....	....	....	0.26	....	....	0.62	T	....	....	T	....	....	....	T	....	0.19	0.03	1.76
Keosauqua	0.03	....	....	....	T	0.35	....	T	....	....	....	....	....	0.29	T	....	0.32	T	....	....	T	T	....	....	T	....	0.45	T	1.44
Larrabee	....	0.10	....	....	....	0.01	....	....	0.01	....	....	....	....	0.12	....	....	0.08	....	....	....	T	....	....	T	....	0.20	0.27	....	0.79
La Crosse, Wisconsin	....	0.19	T	....	....	0.02	....	....	0.14	0.06	....	....	....	0.18	....	....	....	T	....	....	T	T	0.02	....	....	0.12	0.60	0.41	1.74
Logan	0.10	0.20	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.60	0.60	....	1.50
Maquoketa	0.05	0.70	....	....	....	0.32	....	....	0.09	....	....	....	....	0.22	....	....	....	....	....	....	T	....	....	....	....	....	0.33	....	1.72
Marshalltown	....	0.20	....	....	....	0.05	....	....	0.02	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.05	....	....	0.05	0.25	0.60
Maxon	T	0.05	....	....	....	0.15	....	....	T	....	....	....	....	0.20	....	....	T	....	....	....	T	....	....	T	....	0.60	....	....	1.00
Monticello	....	0.15	....	....	....	0.08	....	....	0.18	....	....	....	....	0.20	....	....	....	....	....	....	....	....	0.01	....	....	....	0.70	....	1.32
Murray	....	0.05	....	....	0.10	0.05	....	....	....	....	0.18	....	0.01	T	....	....	T	....	....	....	0.01	....	....	T	....	0.02	0 18	....	0.60
Newton	T	0.11	....	....	....	0.22	....	....	0.05	....	T	....	....	0.13	....	....	T	....	....	....	T	....	....	T	0.01	0.10	0.35	0.03	1.00
Omaha, Nebraska	0.07	0.21	....	....	....	0.01	....	....	0.01	....	....	0.04	....	0.14	....	....	T	....	....	....	T	....	....	....	....	0.13	0.34	0.02	0.97
Osage	....	0.30	....	....	....	0.05	....	....	0.05	0.15	....	....	....	....	....	....	0.03	....	....	T	....	....	....	....	....	0.20	0.80	0.75	2.33
Oskaloosa	0.05	0.05	....	....	....	0.08	....	....	0.38	....	....	....	0.20	....	....	....	....	....	....	....	....	....	....	....	....	....	0.36	....	1.12
Panama	....	0 17	....	....	....	....	....	....	....	....	....	....	0.11	....	....	....	....	....	....	....	....	....	....	....	....	0.21	....	0.67	1.16
Richland	T	0.31	....	....	T	0.34	....	....	0.03	....	....	....	....	0.25	....	....	T	....	....	T	....	....	....	T	....	0.22	T	....	1.15
Sac City	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	T	....	....	....	....	....	....	1.20	1.20
Sioux City	....	0.14	....	....	T	0.04	....	....	0.09	....	....	....	0.12	0.10	....	....	0.01	....	....	....	T	....	T	0.01	0.02	0.11	0.21	T	0.77
Storm Lake	....	0.16	....	....	....	0.10	....	....	0.01	....	....	....	....	0.10	....	....	0.03	....	....	....	T	....	....	....	0.06	0.22	0.60	0 20	1.48
Tipton	0.10	0.90	....	....	....	0.18	....	0.05	0.11	....	....	....	....	0.27	....	....	0.05	....	....	....	T	....	....	....	T	T	0.64	....	2.30
Villisca	....	0.01	....	....	....	0.05	....	....	....	....	0.15	....	....	T	....	....	....	....	....	....	....	....	....	T	T	T	T	....	0.21
Vinton	....	0.10	....	....	....	T	....	....	0.05	....	....	....	....	0.08	....	....	....	....	....	T	T	....	....	T	T	T	0.26	....	0.49
Washington	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.06	T	....	....	....	....	....	....	....	....	....	....	....	0.24	0.30
Webster City	....	0.12	....	....	....	....	....	....	0.12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.05	....	1.50	1.79
Williams	....	0.20	....	....	....	0.10	....	....	0.10	....	....	....	....	0 08	....	....	0.01	....	....	....	T	....	T	....	0.03	0.08	1.60	....	2.20
Winterset	T	0.30	....	....	....	0.05	....	0.02	T	....	0.02	....	T	T	....	....	T	....	....	....	T	....	....	T	....	0.05	0.50	....	0.94

MAXIMUM AND MINIMUM TEMPERATURE FOR FEBRUARY, 1893.

STATIONS.	1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		Monthly Mean.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Alta	-14	-22	5	- 7	- 9	-18	8	-20	20	- 6	-10	-19	- 2	-22	25	-10	30	10	20	- 2	28	- 2	36	19	36	19	10	- 4	30	-10	25	4	29	9	33	8	37	23	34	9	23	10	32	5	37	14	26	13	30	10	18	8	15	10	23	2	20.9	1.1
Ames (F.C.Stew'rt)	- 2	-23	11	-15	- 2	-16	-10	-24	39	6	18	-19	- 2	-22	20	-21	29	17	28	3	25	-11	38	7	37	12	36	12	27	-11	31	5	26	14	32	8	40	19	30	9	32	21	30	2	34	14	32	15	32	8	30	7	35	19	29	8	25.2	1.6
Amana	- 5	-12	23	- 5	- 3	-12	12	-17	39	12	- 5	- 9	1	-15	17	-17	33	17	20	11	22	- 5	36	15	38	16	40	12	23	- 2	29	8	28	16	27	12	37	22	36	10	30	21	30	7	32	22	27	18	28	11	32	6	40	30	32	14	24.5	6.6
Atlantic	- 1	-15	26	-11	3	-17	30	-21	44	6	10	-14	5	-18	27	-17	29	3	30	3	28	- 1	41	30	42	23	40	5	29	- 4	34	7	32	20	43	17	50	27	41	15	30	17	33	8	46	21	36	19	44	12	39	21	31	14	33	7	31.2	5.4
Audubon	- 6	-18	6	-14	- 4	-16	23	-17	37	3	4	-16	0	-20	23	-10	28	11	23	2	30	- 6	36	14	40	20	37	3	27	- 4	29	10	31	16	37	13	43	27	34	13	33	15	32	18	40	18	33	18	34	13	33	17	21	11	29	2	26.2	4.4
Belle Plaine	- 8	-14	28	- 8	- 5	-15	9	-19	41	8	- 5	-12	- 1	-16	19	-15	33	16	19	9	21	- 5	35	12	39	18	38	7	21	- 4	29	9	28	14	27	11	36	20	37	9	30	18	31	4	32	19	33	18	31	10	31	9	40	25	31	12	24.6	5.0
Blockton	20	-13	15	-10	7	-10	25	-11	47	15	25	-11	5	-15	23	- 8	35	8	30	2	34	8	40	10	45	20	38	12	40	0	35	8	34	20	38	18	44	30	37	19	33	22	34	9	33	20	43	25	34	20	48	14	45	15	36	10	32.9	7.0
Bonaparte	8	-10	23	- 3	8	-10	20	-14	40	18	37	- 9	5	-13	20	- 8	35	18	35	12	30	18	40	12	39	17	29	5	33	28	29	18	33	14	42	23	30	11	32	20	32	10	35	19	35	23	36	14	41	18	44	32	44	16	31.2	10.6
Carroll	...	-19	...	-15	...	-15	...	-18	1	21	-10	-18	40	2	22	0	29	11	27	- 2	26	4	37	12	40	18	15	5	32	- 4	28	7	31	19	37	17	39	18	36	18	34	16	32	17	37	10	39	19	33	15	28	16	24	2	28	2	28.5	4.2
Cedar Falls	5	-16	13	-12	10	-10	20	-23	37	20	15	- 9	5	-17	10	-15	29	10	15	-15	25	- 5	38	15	37	10	37	30	26	- 8	33	8	33	10	30	5	28	6	37	10	32	12	27	1	31	18	35	10	31	5	30	16	37	28	30	4	29.1	3.5
Cedar Rapids	- 5	- 8	22	5	- 1	- 4	15	-16	40	9	- 2	- 8	- 1	-12	20	-13	33	14	22	15	20	2	35	18	40	22	41	36	24	2	27	10	28	18	27	14	40	20	30	14	32	18	21	9	30	18	33	22	31	12	31	14	42	29	24	16	25.0	9.9
Centerville	22	-14	17	- 9	9	- 7	18	-14	42	12	38	-10	3	-16	27	- 7	32	20	32	10	30	2	40	22	43	21	36	18	38	2	34	16	34	18	34	16	42	24	34	14	32	22	34	8	38	22	36	20	42	12	44	16	46	32	46	12	33.0	9.4
Charles City	-14	-21	6	0	- 6	-14	6	-28	34	14	- 5	-14	0	-23	18	-20	26	21	26	4	15	-13	34	14	40	18	35	- 4	15	-12	32	4	30	10	18	8	28	26	32	10	23	-18	24	-1	28	20	32	10	25	- 4	20	5	24	22	34	8	20.0	0.8
Clarinda	- 8	-15	13	- 9	- 1	-12	27	-12	45	1	1	-13	5	-15	23	- 3	33	12	25	7	28	5	41	12	44	22	37	4	25	1	32	12	33	11	38	19	46	25	35	20	30	18	33	13	41	25	33	21	38	19	41	27	28	13	33	11	28.5	7.8
Clinton	11	- 3	25	- 3	14	-10	15	-16	36	12	33	- 8	3	-15	17	-16	33	16	34	5	22	- 9	35	0	38	11	38	17	21	1	30	5	26	15	26	14	38	13	25	1	32	18	32	11	29	23	31	20	25	8	33	6	40	31	39	16	27.6	5.8
College Springs	- 8	-15	13	- 9	- 1	-12	27	-12	42	24	- 3	-11	3	-17	24	0	35	20	24	6	30	7	39	13	43	24	19	6	25	- 5	34	10	35	21	38	16	44	22	34	19	34	25	36	10	41	21	42	26	37	15	43	26	31	25	34	8	28.4	9.4
Corning (J.M.Bix'y	0	-16	11	-13	2	-12	21	-15	43	7	7	-13	5	-17	25	- 6	33	13	26	6	25	0	39	16	40	19	34	8	27	2	32	12	32	18	38	17	49	36	34	18	33	19	31	10	42	32	37	23	40	16	40	22	33	13	32	10	29.0	7.7
Cresco	-14	-20	10	-13	-11	-24	5	-27	36	2	- 9	-14	- 4	20	14	-18	26	14	15	2	21	- 7	31	9	44	16	37	1	19	-13	26	6	30	7	22	6	33	11	20	0	25	15	27	1	26	18	24	7	21	- 4	18	- 8	35	15	24	9	19.5	- 1.0
Davenport	2	- 6	25	- 1	0	- 7	15	-14	37	14	7	- 6	- 2	-13	16	- 8	32	16	20	15	22	0	37	9	39	17	39	19	32	2	30	14	24	18	27	12	38	20	23	8	31	20	28	12	30	25	32	23	33	14	34	14	42	34	32	16	25.2	9.6
Decorah	20	-16	10	- 6	7	-24	18	-20	41	-15	0	-18	23	- 8	26	- 4	21	- 5	31	- 8	30	- 6	38	9	48	- 8	21	- 3	17	- 6	23	4	26	8	31	- 4	59	0	37	6	36	3	33	0	30	18	31	7	28	-11	40	- 2	28	1	35	7	27.4	- 3.6
Denison	-15	-19	17	-12	14	-16	24	-16	36	0	24	-15	15	-19	25	- 7	34	11	28	2	29	- 3	38	5	37	35	37	1	32	- 2	34	11	34	17	...	...	47	15	38	15	36	10	33	10	42	18	36	20	36	16	...	...	30	9	...	1	29	8	3.3
Des Moines	- 6	-16	10	- 9	- 4	-10	13	-16	41	8	- 5	-12	2	-15	22	- 9	32	20	23	10	25	- 2	40	16	41	20	37	12	29	- 1	32	14	32	18	35	15	42	26	32	16	34	22	32	9	38	21	30	22	34	15	34	18	45	21	32	12	26.9	8.0
Dubuque	- 4	- 8	17	- 6	0	-12	10	-21	36	9	4	- 7	- 4	-15	12	-14	32	12	26	16	28	- 3	34	8	38	20	40	21	22	0	25	6	25	12	26	14	37	19	21	4	31	17	18	14	28	24	27	22	24	6	28	2	40	25	29	14	23.6	6.4
Elkader	- 4	-10	9	- 9	- 2	-16	6	-24	34	4	0	-10	1	-16	14	-27	28	12	26	6	29	-12	36	0	41	4	38	12	23	- 9	28	-6	28	8	30	6	40	13	24	- 3	29	18	31	5	30	24	32	18	28	4	27	-2	41	22	30	13	24.2	0.9
Emmetsburg	-16	-26	13	-17	-14	-20	5	-24	37	-10	-10	-20	-10	-21	26	-16	34	12	23	- 3	24	- 6	39	9	40	12	34	- 4	33	- 9	29	-2	27	5	34	5	32	19	34	7	32	8	32	3	34	12	23	12	23	11	20	4	13	10	23	2	21.9	- 1.7
Fayette	- 5	-14	10	- 7	9	-18	10	-22	36	10	20	-12	- 3	-17	15	-19	28	14	25	5	26	-11	35	6	42	16	37	7	22	- 9	32	5	27	9	25	9	34	19	22	-2	27	20	29	0	27	20	26	14	23	1	25	0	38	21	29	12	24.0	2.0
Galva	- 7	-20	13	-13	- 3	-16	16	-17	36	2	2	-17	2	-19	27	-12	35	...	24	0	35	- 7	37	19	39	22	32	2	33	- 7	28	5	30	11	38	10	38	24	38	10	34	17	34	7	39	17	32	17	37	9	35	13	15	12	25	2	26.5	2.6
Glenwood	- 6	-17	12	6	2	-16	30	-16	50	0	- 4	-14	6	-18	24	0	38	14	35	6	28	10	44	24	42	24	42	6	32	0	44	14	38	20	50	22	60	34	42	20	46	24	46	14	50	28	42	25	32	26	40	28	40	10	40	16	33.8	10.4
Greenfield	- 3	-18	13	-12	- 7	-17	22	-17	43	6	6	-15	1	-21	24	- 9	22	1	31	2	32	2	38	14	43	17	35	3	26	- 4	30	11	33	16	36	12	41	26	35	13	36	15	34	6	36	18	34	13	36	15	34	6	35	15	25	6	27.6	4.3
Grinnell	3	-16	...	...	...	...	9	-17	36	8	23	-14	1	-14	17	- 6	30	15	27	9	21	3	35	17	35	22	35	14	22	2	28	0	26	16	29	15	36	27	27	14	28	20	28	10	32	22	29	20	25	16	29	16	40	25	34	13	26.3	9.5
Grundy Center	2	-21	15	-11	- 8	-22	10	-18	38	-13	- 8	-19	- 2	-18	18	-10	29	22	20	5	23	- 5	37	13	35	15	35	- 7	25	- 7	31	5	27	15	29	10	32	7	28	8	26	4	29	4	31	19	31	7	26	6	26	12	40	9	36	10	23.4	0.7
Hampton	-13	-22	12	- 3	-13	-20	7	-23	36	2	-10	-16	- 3	-19	19	-15	29	15	13	0	21	- 6	35	17	35	13	34	0	24	- 8	27	5	25	9	29	8	34	20	25	5	25	12	28	1	29	12	24	14	25	4	24	6	35	15	25	6	20.8	1.1
Independence	0	-16	13	-12	- 1	-19	6	-23	37	3	3	-11	- 1	-18	14	-16	30	12	32	7	27	- 5	34	7	36	13	37	12	32	- 8	28	4	26	10	27	9	35	19	30	3	29	17	28	3	28	20	29	14	26	4	27	2	38	22	40	12	24.3	2.3
Indianola	8	-17	9	-11	...	...	15	-17	42	9	30	-12	1	-16	22	- 6	32	20	31	9	25	1	39	17	40	24	37	14	29	- 2	36	12	28	18	34	14	40	28	39	15	32	22	32	12	36	22	35	22	36	15	34	19	46	25	32	12	28.7	8.8
Iowa City	34	-10	22	- 5	13	- 7	10	-16	38	10	37	- 6	3	-14	15	-18	32	14	34	14	26	- 2	38	10	38	17	39	17	24	- 1	33	5	28	16	38	12	39	23	35	8	31	20	29	8	32	22	32	20	29	12	32	10	40	29	41	14	30.1	7.2
Jefferson	30	-22	12	-16	12	-17	10	-20	39	4	40	-17	- 2	-21	26	-16	31	21	31	10	28	- 8	37	8	39	15	40	12	26	- 8	29	6	33	14	34	10	39	24	40	23	35	24	29	4	34	16	36	18	38	9	30	13	33	17	26	4	29.8	3.8
Keokuk	- 3	- 9	25	- 4	6	- 2	20	-12	43	19	2	- 5	4	-11	23	- 3	38	19	27	14	28	6	40	5	40	22	47	23	31	9	34	24	31	20	31	17	45	27	28	11	34	20	34	12	36	28	35	26	36	18	40	18	48	37	35	18	30.2	12.4
Keosauqua	34	- 8	17	- 4	13	- 3	15	-11	38	15	37	- 5	9	-11	19	- 6	34	15	34	14	29	4	39	15	39	19	39	21	32	7	33	18	29	20	34	16	45	25	35	14	33	20	33	12	35	26	36	22	38	15	45	19	43	34	43	17	32.5	11.4
La Crosse, Wis	- 9	-16	11	- 3	- 2	-16	9	-26	37	- 4	0	-10	0	-16	17	-17	29	13	26	14	26	14	38	10	43	21	41	17	26	- 4	28	11	26	8	27	15	34	20	25	- 2	30	18	31	12	30	24	27	18	23	5	20	- 2	42	17	28	14	23.7	4.1
Larrabee	-13	-22	12	-13	10	-20	9	-20	34	- 3	- 2	-19	- 1	-23	28	-12	33	10	22	- 4	32	- 7	38	15	38	22	32	- 2	35	-12	27	2	32	10	35	11	39	22	40	8	22	10	37	4	39	14	28	13	28	9	26	9	17	16	26	3	24.9	0.5
Logan	- 8	-16	11	- 8	- 7	-13	25	-13	40	- 2	2	-13	5	-16	30	-11	36	15	30	5	30	- 1	27	18	37	27	11	6	38	0	37	13	37	19	39	21	49	20	26	24	48	19	35	9	36	24	35	25	40	19	36	20	22	13	25	4	27.3	7.6
Marshalltown	30	-17	13	-14	13	- 9	3	-17	30	3	38	-12	4	-14	18	- 8	29	17	31	9	20	0	31	17	32	19	37	20	22	- 1	28	11	29	16	30	13	35	24	37	14	31	23	28	8	30	20	33	22	23	13	30	14	40	23	44	13	27.5	7.4
Murray	3	-15	11	-10	- 8	-10	28	-14	42	11	- 5	-12	2	-16	26	- 5	32	11	24	7	25	6	39	14	40	19	35	12	29	1	32	14	31	18	36	15	42	31	43	16	36	20	32	9	38	18	33	22	38	15	40	20	47	16	33	11	28.7	8.0
Newton	10	-17	12	-11	2	-11	10	-19	41	7	37	-13	2	-18	21	-14	31	18	31	7	21	- 2	38	14	38	17	36	14	26	- 2	30	12	29	16	31	12	41	12	32	12	30	19	31	7	33	21	33	19	30	14	32	13	41	27	41	10	28.1	5.8
Omaha, Neb	- 8	-16	7	-11	- 5	-13	29	-13	38	3	- 6	-14	6	-16	28	1	34	15	27	8	28	12	41	20	40	30	11	7	35	5	32	18	37	20	47	25	52	36	42	20	31	25	36	18	48	28	36	27	37	22	35	22	17	14	34	10	28.2	10.9
Oskaloosa	3	-12	15	- 6	6	- 9	13	-16	42	11	29	- 9	4	-15	20	-13	33	20	24	11	26	15	41	17	39	19	35	14	25	0	30	9	30	18	33	14	42	24	30	14	31	21	38	8	35	24	33	21	32	11	36	16	42	22	35	4	28.6	8.7
Panama	-6	-17	5	-13	- 2	-15	22	-14	35	0	1	-15	3	-18	24	- 8	29	12	23	4	28	- 2	36	12	37	24	35	4	29	- 4	28	12	31	18	41	15	42	31	37	15	35	18	32	10	42	21	36	21	31	15	28	17	18	11	31	4	26.1	5.6
Sac City	-12	-21	12	- 8	- 9	-17	9	-18	36	- 4	- 8	-17	- 4	-19	- 2	-12	6	- 7	5	- 9	17	9	38	17	39	14	11	8	37	- 7	31	4	32	9	31	16	39	29	40	10	25	10	32	9	36	16	26	17	25	19	23	18	15	10	27	3	19.9	2.8
Sioux City	- 7	-21	8	-13	- 9	-18	18	-16	37	- 2	- 6	-17	4	-18	33	-12	29	12	25	4	28	- 1	43	17	41	28	13	2	36	- 5	31	8	35	15	43	15	42	33	40	18	27	20	37	13	45	22	30	19	30	15	20	15	15	10	29	6	25.3	4.8
Storm Lake	- 4	-21	9	-16	2	-17	7	-19	31	4	6	-18	- 1	-20	24	-12	30	15	24	0	26	- 2	36	18	35	18	33	5	31	- 7	28	4	29	10	34	9	39	25	33	9	33	17	31	7	36	15	37	15	30	15	31	9	16	11	32	3	24.9	2.8
Tipton	2	-10	24	- 2	7	-12	13	-18	38	11	35	- 8	2	-15	17	-14	34	17	35	8	28	- 3	38	12	29	15	40	10	25	- 3	37	10	26	14	29	11	38	26	26	6	32	21	...	...	30	8	32	21	29	10	32	9	40	32	40	14	27.4	6.1
Villisca	31	- 9	11	-11	17	- 4	14	-12	32	- 3	39	-11	22	-16	16	-16	30	5	35	8	38	3	31	10	39	27	42	17	24	1	32	7	39	21	38	19	45	20	55	29	45	26	33	12	37	25	47	24	37	19	46	24	40	28	35	11	33.9	9.1
Winterset	-12	-17	2	- 1	- 1	-11	20	-17	44	11	- 8	-13	1	-18	24	- 9	31	27	25	6	28	0	40	17	42	22	35	13	28	- 2	32	12	30	18	35	14	32	30	33	16	29	21	33	8	36	20	33	20	36	15	37	20	36	21	30	9	26.5	8.3

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Ames	E. C. Dickinson.
Ames	E. N. Eaton
Ames, (4 miles S. W.)	Isaac Young.
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Audubon	J. F. Hocker.
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MONTHLY REVIEW

OF THE

Iowa Weather and Crop Service.

VOL. IV.—MARCH, 1893.—NO. 3.

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CENTRAL STATION, DES MOINES, IOWA.

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DIRECTOR.

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LOCAL FORECAST OFFICIAL,
U. S. WEATHER BUREAU, ASS'T DIRECTOR.

DES MOINES:
G. H. RAGSDALE, STATE PRINTER.
1892.

THE IOWA WEATHER AND CROP SERVICE

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U. S. Department of Agriculture---Weather Bureau.

MONTHLY REVIEW

OF THE

IOWA WEATHER AND CROP SERVICE.

VOL. IV.] MARCH, 1893. [No. 3.

EDITORIAL NOTES.

In Iowa, real estate men who own farms are extremely indignant at the decision of the new State auditor relative to improved lands. He has handed down an opinion to county officers in effect that he believes all land fenced should be assessed as improved. In as much as a large number of acres of Iowa land is prairie, but is fenced with barbed wire in order to determine boundary lines, there is much objection to the decision of the auditor in so much as it adds a third to the total land taxes in the State. The complaints on the part of owners of prairie land are loud and numerous.—*Rural Northwest.*

The decision, or opinion, of the State auditor, referred to above, related to the classification of lands by assessors solely for the purpose of obtaining reliable crop statistics, and not in any manner affecting assessments for taxation. The special value of an accurate census of lands used for agricultural purposes is to give the crop bureau a basis of acreage in estimating the farm products of this State. No man's taxes will be increased a cent by the auditor's letter of instruction relating to this matter of classification.

***

The southern limit of snow passed northward of Iowa at the close of March. There were occasional drifts visible in the northern districts. Considerable seeding was done the last week of the month.

***

Crop correspondents should take note of the spring pig crop as compared with the average of recent years. It is one of the most important crops of the season, as last year's experience shows.

***

Despite the fact that all forage crops were unusually heavy last season, there is a notable scarcity of fodders. This is one of the results of the severe winter. All domestic animals have great appetites in zero weather.

***

The ice in the Des Moines river near the central station began to break up March 10th, and the most of it had passed away about the 18th. About the only local damage noted was the breaking of the dam of the Des Moines Electric Light Company.

***

A thunder storm visited Creston, March 27th, and a 15-year-old son of Henry Taylor was struck by lightning and instantly killed.

***

Prof. Jas. Wilson says: "The wastes of the farm, through want of knowledge how to save, are heavier than all taxes."

***

A very severe hail-storm visited El Reno, Oklahoma, on the night of March the 22d. Windows and roofs were broken, and people who chanced to be out of doors were compelled to flee for their lives. Unsheltered stock suffered severely. The storm was a part of the cyclonic movement which bred the tornadoes and wind squalls that wrought great havoc in localities in Mississippi, Tennessee, Indiana and Kentucky.

***

The statistician of the Department of Agriculture estimates that the Dakotas now produce more wheat than was grown in the United States fifteen years ago; and the exports of last year were greater than the aggregate product twenty-five years ago.

***

In a note to *Science*, Prof. Sweezy, of Crete, Neb., says: "Referring to the article of Mr. J. T. Willard in *Science* for December 16th, with reference to a 'breathing well' in Kansas, I would say that such wells are also common in Nebraska. I have compared their behavior with the fluctuations of the barometer, and my observations agree with those of the writer in throwing the entire dependence of the air movements in the well upon the changes in the atmospheric pressure outside. The cessation of an outward current from the well always corresponds with a curve of barometric depression, but always occurs some hours later than the minimum of pressure, and the amount of retardation depends upon the slowness with which the barometer rises. These wells have often given considerable trouble in cold weather, as

the influx of cold air is liable to freeze the water in the pump at a considerable depth below the surface of the ground."

***

In a discussion of the question, "Is the Climate Changing?" by Professor H. A. Hazen, in the current number of the *Engineering Magazine*, some remarkable data are presented in relation to the stability of the climate in historic times. In Palestine seed-time and harvest occur today precisely as they did according to records supposed to be thirty-three centuries old. During thousands of years in China there has been no change in the character of their cultivated plants, in the dates of breeding silk worms, or of the migration of birds. A record of the breaking up of the ice in the River Duna, at Riga, Russia, has been kept since 1530. A table is given showing the dates in seven periods of fifty-four years each, and the mean date of the several periods has ranged between March 19th and 28th. Similar uniformity of dates is shown in the record of the vintages in Dijon, going back to the fourteenth century. A remarkable uniformity of the rainfall is shown by records kept from an early date in Paris, in England and in Italy.

IOWA'S GYPSUM DEPOSITS.

BY DR. CHARLES R. KEYES, ASSISTANT STATE GEOLOGIST.

Gypsum is a substance widely distributed throughout Iowa. It occurs more or less abundantly in nearly every geological formation exposed within the limits of the State. The only deposit in Iowa of commercial value, however, is an area found in Webster county, in the neighborhood of Ft. Dodge. These gypsum beds have long been known to be among the most important deposits of the kind in the United States; while their geographical position makes them the most valuable known in the Mississippi valley.

In the manufacture of plaster-of-paris Iowa ranks second, and in the total production of gypsum, third, among the states of the Union. According to the report of the eleventh census the total production for 1889 was as follows:

	TONS.	VALUE.
Michigan	131,798	$373,740
New York	52,608	79,476
Iowa	21,784	55,250
Kansas	17,332	94,235
Utah	16,000	25,000
Ohio	9,290	51,491
Colorado	7,700	28,940
Virginia	6,838	20,336
California	3,000	30,000
Wyoming	500	3,000

The gypsum beds of Iowa occupy approximately twenty-eight square miles in the central portion of Webster county, a short distance northwest of the middle of the State. The deposit forms an irregular oval area, lying chiefly to the southeastward of Ft. Dodge.

Topography.—Traversing the Iowa gypsum area in a southeasterly direction, and cutting it into two nearly equal halves, is the Des Moines river. A few miles back from the stream the surrounding country is quite level, with scarcely any marked differences in elevation; but toward the chief water course deep ravines appear, sloping steeply toward the river, whose bed is from 130 to 150 feet below the general level of the country.

In Webster county the Des Moines river valley is very narrow with scarcely any alluvial flood plains. The sides of the valleys are very steep, even precipitous. All the minor tributaries of the chief water course likewise flow in narrow, steep-sided ravines, very deep toward their lower extremities, but in the opposite direction passing into small, broad, shallow drainage basins. The ravines are very numerous, close together, and very tortuous. They are separated from one another by sharp, narrow ridges.

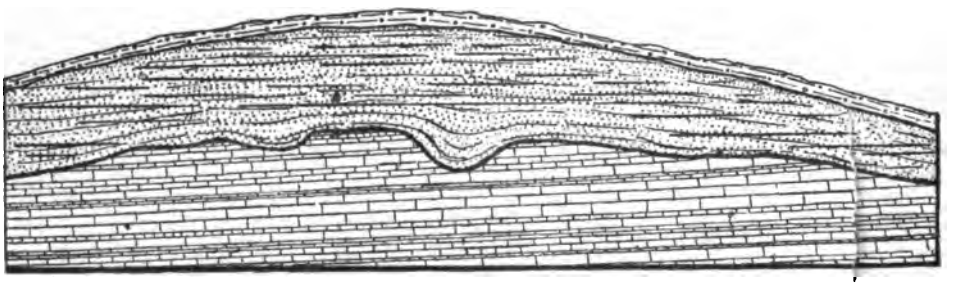
Geological Formations.—Although deeply covered by drift material the underlying stratified rocks are well exposed along the Des Moines river and its minor branches everywhere throughout the county. Aside from the surface deposits—the glacial debris—three formations, very distinct geologically, are found within the gypsum area. They are:

(1) The Gypsum beds and associated deposits, which are probably of Cretaceous age.

(2) The Lower Coal Measures.

(3) The St. Louis limestone, the uppermost member of the Lower Carboniferous in Iowa.

St. Louis Limestone.—In the northern portion of the gypsum area there is exposed, a few feet below the deposit, a compact, ash-colored lime-rock which breaks with a somewhat conchoidal fracture. Fossils show that the limestone belongs to the part of the lower Carboniferous series, known farther southward as the St. Louis division. Toward its northern limit the gypsum bed rests directly upon the St. Louis limestone, but southward it is separated from the Lower Carboniferous rocks by fuliy one hundred feet of Coal Measure shales. The St. Louis limestone throughout Webster county has the upper surface very unevenly eroded, the overlying rocks reclining unconformably upon it. This is well shown in the following section:



The lower part of the section—below the irregular median line—is a blue, fine-grained limestone, in places closely resembling lithographic stones. This is the St. Louis limestone. It is overlaid by a soft friable sandstone, somewhat shaley and buff in color. Above it a few yards back from the face of the exposure are dark colored Coal Measure shales. Similar sandstones are known to occupy eroded depressions in the St. Louis limestone at numerous other localities in the State. In other parts of the gypsum area the St. Louis rock is separated from the gypsum beds by a few inches or feet of shaley ferruginous sandstone.

The Lower Coal Measures.—By far the greatest portion of the gypsum area is immediately underlaid by Coal Measure strata. In the northern part of the district near where the gypsum beds rest on the St. Louis limestone the Upper Carboniferous layers are poorly represented; but toward the southern limit of the region, as has been said, more than one hundred feet of Coal Measure shales are to be found between the Lower Carboniferous limestone and the gypsum deposits. The Coal Measure rocks are chiefly of clay-shales with some sandstone. There are also several distinct beds of coal which have for a long time been extensively mined throughout the region. The exact line of limitation between the gypsum beds and the underlying rocks is seldom encountered, but it is apparently quite irregular.

A careful measure of over twenty of the leading gypsum exposures show that the beds were deposited on the slightly uneven surface. The difference in elevation between the north and south exposures is about thirty feet, the northern part being the higher.

The Gypsum Beds.—The Ft. Dodge gypsum deposits vary in thickness from two to thirty feet or more, the average measurement being sixteen feet. The gypsum formation is perfectly massive and is made up of numerous thin layers of gray and white alternating bands of pure and impure calcic sulphate. The different colored layers vary from one-eighth to one-half an inch in thickness and are finely corrugated. The lower part of the deposits, although not strikingly different from the upper portion, contains considerable amounts of impurities and in the manufacture of the material for commercial purposes this part is usually ground into land plaster while the upper portion is made into stucco. The gypsum beds appear to be thoroughly crystalline throughout, the individual crystals being columnar or needle-like, ranged closely together with their lengths at right angles to the bedded planes. This arrangement seems to be uniform throughout the entire deposit.

Related Strata.—Above the gypsum in certain places, as at Kohl's brewery for example, there are exposed beds which were manifestly deposited at the same time as the main gypsum layers. These are chiefly sandy shales which pass into friable, massive sandstones. In various places, however, throughout a vertical height of twenty-five to thirty feet there are thin layers from a quarter to a half an inch in thickness of typical gypsum widely separated from one another and from the massive beds below. These thin gypsum layers are highly corrugated, broken portions of which appear like a letter S, with a width of fully three inches. At first glance the beds immediately overlying the gypsum appear to be deposited unconformably, but closer investigation shows plainly that such is not the case. Percolating waters have dissolved and carried away portions of the upper part of the great gypsum bed, allowing the superimposed beds to settle down on an apparently uneven surface.

Overlying Beds.—The gypsum beds are chiefly overlaid by a thick deposit of drift material. This unconsolidated covering varies in thickness from a few to sixty or even seventy-five feet. In some places Cretaceous sandstones and shales overlie the chief gypsum layer, but these have only been observed in a few places.

Origin of the Gypsum.—One of the commonest questions asked in the gypsum region is in regard to the formation of the deposit. The beds of the Ft. Dodge district are so different from the associated layers, that the query is naturally among the first to present itself to those coming in contact with the strata under consideration.

Of the half a dozen ways in which gypsum is ordinarily formed in nature, the last here mentioned is manifestly the one in which Iowa beds are deposited. One of the most universal perhaps, though carried on usually on a comparatively small scale, is by the breaking down of lime in the form of the carbonate, and the sulphates of iron or copper in the same layers, as in many clay shales. Another similar way is by the action of decomposed sulphides, as iron pyrite, on limestone. In volcanic districts gypsum is a common resulting mineral where sulphurous fumes or acidulated waters pass through lime-bearing rocks. The common mineral anhydrite taking up water frequently forms more or less extensive deposits of gypsum. Still another way and probably the most prevalent is through chemical precipitation.

As already remarked, the Ft. Dodge gypsum beds doubtless originated according to the last of methods just mentioned. It will be seen hereafter that the Iowa gypsum deposits are probably Cretaceous in age; that they probably belong to the upper part of the Mesozoic formation as represented in the State. At the time referred to the area within the present boundaries of Iowa had been depressed, allowing the Cretaceous sea to invade the northwestern half of the territory. Owing to another slight oscillation of the land, the waters rapidly retreated. Depressions in the old land surface would be occupied for a while with saline lakes of greater or less extent, cut off completely from the ocean. As evaporation went on rapidly in these land-locked bodies of salt water, they would become more and more dense, and assume greater salinity until the various salts would be precipitated one after another on the floors of the different lakes. Now these salts fall in order of their solubility; boracite, anhydrite, gypsum, rock salt and then others more easily soluble. The process is not unlike that now going on in existing saline lakes where it has been found that the gypsum is formed where the degree of saturation of the water is such that thirty-five to forty per cent of the ordinary sea water has been driven off. When more than twice this

amount of water is evaporated, common rock salt begins to crystallize out. With the deposits of gypsum and common rock salt so closely associated, it seems not improbable that the latter may be discovered sooner or later in the neighborhood of the Iowa gypsum area. The rock salt, however, is not a necessary accompaniment of the gypsum. The water may originally never have become so concentrated as to allow this mineral to be thrown down. Or, if it once had been deposited upon the gypsum percolating waters may have removed all the sodium chloride, since it is very much more soluble than the gypsum.

Above the main gypsum beds there are numerous thin bands of the same mineral interstratified with clay and sandy shales. This with the narrow banding of the great bed and the relations of the associated strata seem to point clearly to the origin of the Ft. Dodge gypsum as a chemical precipitate.

Geological Age of the Gypsum.—Those who have referred to the geological relations of the Fort Dodge gypsum beds all agree in considering them Post-Carboniferous age. As early as in 1865 Hall incidentally correlated these deposits with certain red marls and ferruginous sandstones of southwestern Minnesota, which he regarded as "not older than Triassic." White appears to have found abundant evidence for believing that the gypsum beds rested unconformably on the underlying rocks. As to geological age he was of the opinion that they were Mesozoic "perhaps older than Cretaceous." McGee has also incidentally referred the gypsum deposits to the Cretaceous.

It has been shown in another place that the Cretaceous deposits of Iowa were laid down on a gradually sinking shore; that the Cretaceous sediments—Woodbury shales and sandstones—were deposited at the beginning of the period of depression and were afterwards covered by the Niobrara chalks. But eastward from the opening sea deposits of the latter named stages shore formations were also formed. The Niobrara stage thus represents the greatest expansion of the Cretaceous waters within the present limits of Iowa.

In regard to the origin of the gypsum there is perhaps no reason for not believing that all the gypsum deposits of the region are to be regarded as chemical precipitations of saline lakes that had originally been cut off from the sea during a period of land elevation. This being the case it could be only during the retreat of Cretaceous waters in the Iowa territory that such salt or land-lock lakes could be formed.

It may be inferred then that since the gypsum deposits appear to lie uncomformably upon the underlying strata, and since the only period for the formation of the saline lakes was during the retreat of the Niobrara waters, the gypsum deposits of Ft. Dodge were probably laid down during the latter part of the Niobrara epoch.

Availability.—The great depth of the drift deposits in many places throughout the gypsum area often makes it extremely difficult to quarry readily, since the cost of removing such great amounts of drift in order to obtain the gypsum makes it impossible to utilize the thinner portion of the deposit. With the introduction of proper apparatus, the striping of the soft material might be accomplished by hydraulic means. The cost of removing the drift would probably be thus very greatly reduced, and enable all of the gypsum to be utilized at a small expense.

Extent of the Deposits.—The gypsum area has recently been surveyed, and a topographical map made of the region. Although a large amount of the gypsum has been removed in the erosion of the valleys of the Des Moines river and its numerous tributaries, the quantity yet remaining is very considerable. At the lowest estimate the mass of gypsum that is found available in the region cannot be less than sixty millions of tons. The valuation of production, when brought into market at present figures, would be more than one hundred and fifty millions of dollars.

According to the most recent information relating to the Ft. Dodge region, the gypsum production has greatly increased during the past two years, and now amounts to more than fifty thousand tons annually. There are now three or four mills, employing one hundred and twenty-five men and a number of teams.

THE COLUMBIAN WINTER.

The winter of 1892-3 has scored a record entitling it to this distinctive appellation, and giving it rank among the "old fashioned winters" so frequently referred to by elderly people. Beginning a little before Thanksgiving its icy grip was maintained with remarkable tenacity, with only a slight relaxation in the form of the usual mid-winter thaw. It has been noted for the frequency and intensity of its cold waves, the wide extent of its boreal influence, its heavy snows, and the unusual number of weeks of good sleighing.

The last monthly bulletin of the Weather Bureau, in its summary for the season, says: "The entire winter has been colder than usual over the principal agricultural districts, the only month showing an excess of temperature since October over an extensive portion of the country being the month of January, during which it was warmer than usual in the Rocky Mountain districts, but it was unusually cold in the eastern half of the United States. The records, therefore, show the principal farming districts have experienced four consecutive months of unusually cold weather."

Referring to the monthly weather reports of a number of stations in the central Mississippi valley, between the 41st and 43d parallels of latitude, we note a temperature record below zero on 15 days in December, 26 days in January and 18 days in February, making 59 days of zero weather for the three winter months. That is a record worthy of note.

All this implies an increased consumption of fuel and heat producing food for man and beast, and a consequent activity of trade in these staple articles of necessity. And it may be reasonably inferred that in the wintering and fattening of stock unusually heavy drafts have been made upon the relatively short crop of corn and oats of 1892. The supply, however, has been ample, and reports from

all the agricultural districts indicate that all kinds of live stock have come through the winter in fair condition.

Though unusually severe it has been an exceptionally healthy winter. There have been no general epidemics, and the germs of disease which were not killed by the prevalent zero temperature have been reduced to a state of suspended animation. In fact, all experience attests that in this latitude the "old fashioned winters," with their dense, cold air and invigorating breezes, are in all respects preferable to the mild, damp and slushy seasons that occasionally visit this region.

Another point to be noted is the fact that, for the time at least, an effectual quietus has been put upon the speculations of certain theorists relative to a change of climate in this mid-continent region. The mooted question: "Are our winters growing milder?" has received a very decided negative answer, and we are brought to the conclusion that in the realm of natural laws, as in human affairs, history repeats itself, and that in cycles of variable length we shall continue to enjoy the visitations of "old fashioned winters."—*J. R. S. in The Inter-Ocean.*

RAINFALL AND DAIRYING.

The advantage of careful study of the *Farmers' Institute* was very forcibly illustrated in the Lyon County Institute a few weeks ago. The question under discussion was whether Lyon county was adapted to the dairy business. It was claimed by some that it was too dry, and in proof of this the fact that the geographies show southeastern Iowa to have an average rainfall of about 40 inches per year, while that of northwestern Iowa has only about 19 inches. This seemed to settle the question until Mr. Priester brought up the State Dairy Commissioner's report, and showing by the diagram of it published in our January issue that the southeastern quarter of Iowa does not produce as much butter as the northwestern quarter, and that notwithstanding the difference in age, the southeastern part of the State was a long way behind the northwestern in dairy products, and therefore it could not be that the dairy business depended on heavy rainfall.—*Farmers' Institute.*

The old-time records did not do full justice to northwestern Iowa in crediting that section with a yearly average of rainfall of only 19 inches. The actual average is about 25 inches a year for the extreme northwestern counties of this State, while the average of the southwestern counties is a little over 35 inches. So the difference in the moisture of these extremes of the State is not so great as the earlier reports would indicate. Another fact should be noted, viz: The western and northwestern districts have a much larger per cent of their yearly rainfall in the six crop months of the year, while the fall and winter months are relatively dry.

The records show that the western half of the State receives a greater summer rainfall than the eastern half but in the winter the conditions are reversed.

In matter of fact, the average summer rainfall of all portions of this peerless agricultural State is more abundant than is enjoyed by the Atlantic and Middle states on this parallel of latitude. The average for the six crop months—April 1st to October 1st—is 23¼ inches. Plenty of moisture in the crop season, with a semi-tropical temperature in the summer months, and a soil of marvelous fertility, are the prime factors of our agricultural prosperity.

Let it be known, therefore, that there is no corner in Iowa that is not adapted to dairying, corn production, and even fruit culture.

LAND VALUES.

The average price of land in Great Britain is $240 an acre according to sales last year. The average price of Iowa lands based on last year's sales would be perhaps $30 an acre, but our lands are steadily rising while British lands have for some time been steadily falling. Inquiry into causes would be interesting. Cheapening transportation is, no doubt, the prime cause. But, even with present facilities to reach the world's markets from Iowa, the surprise is that there is such a difference in prices. Iowa lands go up as money cheapens, and as Iowa farmers progress in farm economy. There is no comparison between the average acre in the State and in Great Britain. Abundant money and home markets for perishable products keep up prices of land abroad. Dearer money and more primitive methods control prices of land here. But as surely as our farmers improve in methods, and money becomes plentier, and transportation cheapens, so surely will our lands appreciate. Money made here—and it is being made fast—seeks safe investment, and every decided step in advance in farm management appreciates the value of the land. We notice with regret the sale of Iowa homes by the pioneers who made them. It is true enough that the purchasers will make good citizens and good farmers, but where better and safer investments will be found than in the acres of the old homestead we cannot imagine. Where a safer walk in life than managing the home farm can be found for the boys we do not know. If would-be sellers would first travel and see the world and compare home advantages with those found anywhere we think the travelers would hesitate to alienate the acres that have done so well in the past and have so much promise for the future.—*Prof. Jas. Wilson.*

EFFECTS OF CLIMATE ON THE QUALITY OF APPLES.

In a paper read before the State Horticultural Society, at its last annual meeting, Prof. L. H. Pammel presented some interesting facts relative to the effects of climate on the quality of apples. From the advance proofs of the proceedings of that body we glean some of the salient points of his paper on that subject.

The burden of testimony seems to be that the flavor, firmness and keeping quality of apples are at their best in the highest latitude in which any given variety can be grown. For example, the Oldenburg becomes a fair dessert apple when grown on the high prairies of Minnesota and Dakota, while in more southern regions it is only fit for cooking. It is a longer keeper in Wisconsin than in central Iowa. The Fameuse in Wisconsin keeps well into February, and its meat is high flavored and richly colored. The Wealthy apple is a much longer keeper in the vicinity of La Crosse than at Ames. In some sections

it may be kept till March, but it is generally considered a fall apple.

The Ben Davis is classed as a winter apple in Iowa and Missouri, but it matures early in Texas, and does not keep beyond October. The apples grown in England are much inferior in quality to those grown on the Continent of Europe, or in America.

Prof. Pammel gives extracts from letters of noted horticulturists. Mr. J. S. Harris writes:

We know that climate does exert a great influence upon most varieties; take the apple the most northern limit where the trees will endure, and bring the fruit to perfect maturity, with the exception of a very few varieties, the better is the quality. The longer days, bright sun and dry atmosphere imparts to them a smoother skin, brighter and more glossy color and sprightlier flavor. The apples grown in Mexico and California, though larger, are much lower in quality than the apples of northern United States. At the meeting of the American Pomological Society held in Washington, September, 1891, the fruits from Minnesota, Wisconsin and northern Iowa presented a much more attractive appearance than those from Maryland and Virginia and attracted general notice. The flavor is very materially changed by climate. Where apples are grown on the high prairies of Minnesota and Dakota, the change is marked. The Oldenburg is a fair dessert apple when grown in such places, but when grown farther south it is only fit for cooking. On the other hand, the Jonathan is very much better grown in Kentucky and Missouri than in Minnesota. Varieties that originated in this climate will show the effect more plainly, and I am free to express the opinion that a race of apples will be originated here that will excel the fruit of every other part of the United States, and the handsomest and best apples the world has ever known will be grown between Lake Michigan and the Rocky mountains north of latitude 42 degrees.

Prof. J. L. Budd writes:

At Denver, on Wheat Ridge, without irrigation, are grown apples of given varieties finer in quality than can be grown in Michigan, or any relatively moist climate. With given varieties we grow handsomer and better fruits than can be grown in climates with more moisture of air. As to keeping qualities, heat has more effect than moisture, but, possibly, a cool air and a moist one may favor keeping. At least it is a fact that Rhode Island Greening and Baldwin are fall apples in Iowa, and good winter apples east of the lakes. The Oldenburg, Wealthy, McMahan and other sorts hardy at the north, keep much longer than when grown south of the 42d parallel.

Prof. Beach, of Geneva, N. Y., writes:

The Wealthy apples I have seen in New York do not compare favorably in size or quality with those I used to get in Iowa. The latter, however, came from younger and perhaps more thrifty trees than the few Wealthy I have seen here.

Prof. L. H. Bailey says:

Apples taken from the north southward become poorer keepers, softer in texture, lower in color, and poorer in quality.

SOLAR ORIGIN OF THUNDER-STORMS.

Dr. M. A. Veeder, of Lyons, N. Y., in a letter addressed to Dr. Geo. M. Chappel, writes as follows, concerning electric storms and solar disturbances:

The outbreak of general thunderstorms in Iowa, Nebraska and vicinity on February 27th, and in Pennsylvania, New Jersey and vicinity, on February 18th and 19th, are typical instances of the solar origin of such phenomena by electro-magnetic induction in the manner which has been pointed out by the writer in various articles and papers, some of which have been sent to you. The rule appears to be that a disturbing area upon the sun exercises its inductive effect when at the eastern limb, appearing by rotation, and that this effect differs, producing auroras sometimes, and thunder-storms at others. It has been found, as a matter of fact, that the substitution of thunder-storms for auroras is most apt to occur when the originating solar disturbance is located upon the hemisphere of the sun farthest removed from the earth at the time. For example, in the cases above noted the solar disturbances at the eastern limb on the dates named were very far north and were confined exclusively to the northern hemisphere, the earth at this season, on account of the inclination of the sun's axis, being opposite the southern hemisphere. Hence the conditions were fulfilled exactly, and there was substitution of thunder-storms upon a phenomenally extensive scale, the unusual season of the year being taken into the account. There are modifications also dependent upon the varying condition of the earth relative to the sun, which tends to localize these phenomena in accordance with the principles governing electro-magnetic induction, which involve the development of special arrangements of lines of force and the like in the earth itself. These are in process of investigation. Yours truly, M. A. VEEDER.

NATIONAL WEATHER-CROP BULLETIN.

WASHINGTON, D. C., April 1, 1893.

TEMPERATURE.

The mean temperature for the month of March differs but slightly from the normal throughout all agricultural districts east of the Rocky mountains, except in the spring wheat regions of Minnesota and the Dakotas. In the Gulf states, the southern portion of the South Atlantic states, and in Missouri and Kansas the average temperature for the month was about 2° below the normal, while in the northern states east of the Mississippi the departure was about 1°, there being a slight excess in Virginia and the upper Ohio valley, with a corresponding deficiency in New England.

Over the spring wheat region the average temperature was from 5° to 10° below the normal. On the north Pacific coast the temperature for the month was from 8° to 6° lower than usual, while in northern Montana the deficiency amounted to from 10° to 12° per day.

The weeks ending March 6th and 20th were decidedly colder than usual throughout the central valleys, including the winter and spring wheat regions and the Gulf states, while the week ending March 13th was decidedly warmer than usual over the region named, showing that the winter wheat has been subjected to trying conditions of freezing and thawing, the effect of which it will not be possible to determine until the crop is further advanced. The week ending March 27th was relatively warm throughout the southern and Middle Atlantic states and the Ohio valley, and cold throughout the northwest.

PRECIPITATION.

The month of March was relatively dry throughout all districts east of the Mississippi, except in Wisconsin and Florida. There was also less rain than usual in the southwest and as far north as Kansas and Missouri. Throughout the cotton region the deficiency in rainfall ranged from two to four inches, except in Texas and western Arkansas, where the rainfall was from one to two inches below the normal, except over portions of the immediate New England coast, where there was a slight excess.

Unusually heavy rains occurred in Florida, where the excess ranges from one to five inches. More than the usual amount of rain is also reported from the states of the upper Missouri valley and the Dakotas, the excess in the east portion of South Dakota amounting to one inch. Excessive rains also occurred in southern and northern

California, and the central portion of the state received almost an inch more than the usual amount. The rainfall in southern California was from three to five inches above the normal, and the reports show that the ground is now filled with moisture and that the conditions are favorable for abundant crops in that section. Oregon received from two to three inches less rain than usual for the month of March, and the state of Washington reports a slight excess.

Throughout the greater portion of the Rocky mountain districts and over the central plateau region there was a general deficiency in rainfall, but reports from Arizona indicate a slight excess in that region.

MARK W. HARRINGTON,
Chief of Weather Bureau.

MAY NORMALS.

The following data, compiled from the record of observations at the Des Moines station for the month of May, during a period of fourteen years, will prove of interest to the public; showing as they do the average and extreme conditions of the meteorological elements, and the range within which the variations may be expected to keep during any corresponding month.

TEMPERATURE.—Mean or normal temperature, 60° The warmest May was that of 1880, with an average of 67°; the coldest May was that of 1888, with an average of 54°. The highest temperature during any May was 94°, on the 21st, 1886; The lowest temperature during any May was 32°, on the 7th, 1890. Average date on which last "killing" frost occurred, May 17th.

PRECIPITATION (Rain and melted snow).—Average for the month, 5.19 inches. Average number of days with .01 of an inch or more, 12. The greatest monthly precipitation was 9.76 inches, in 1883. The least monthly precipitation was 1.70 inches, in 1885. The greatest amount of precipitation recorded in any 24 consecutive hours was 2.91 inches on 8th and 9th, 1883. The greatest amount of snowfall recorded in 24 consecutive hours (record extending to winter of 1884-5 only) was T on May 20, 1892.

CLOUDS AND WEATHER.—Average number of cloudless days, 9. Average number of partly cloudy days, 11. Average number of cloudy days, 11.

WIND.—The prevailing winds have been from the N and NW. The highest velocity of the wind during any May was N, 46 miles on May 10, 1889.

GEO. M. CHAPPEL, M. D.,
Local Forecast Official U. S. Weather Bureau.

MARCH WEATHER REPORT.

Very nearly normal weather conditions prevailed during the month of March, and spring was ushered in about the usual date. The daily mean temperature averaged about one degree lower than the seasonal normals. The precipitation, mostly in the form of snow, was about the average amount for the month. The closing days of the month were favorable for the beginning of farming operations, and considerable seeding was done in the various sections.

The following table gives, as a basis of comparison, the mean temperature and total precipitation for the month of March, at the stations named, in the years from 1872 to 1893, inclusive:

YEARS.	MEAN TEMPERATURE, DEGREES.						PRECIPITATION, INCHES.					
	Des Moines.	Davenport.	Dubuque.	Keokuk.	Omaha.	Sioux City.	Des Moines.	Davenport.	Dubuque.	Keokuk.	Omaha.	Sioux City.
1872	....	32	....	34.7	31	....	.....	1.82	.....	2.88	1.61	.....
1873	....	36	...	38.0	38	....	.....	1.43	.....	0.51	0.44	.....
1874	....	34	23	38.1	34	....	.....	1.34	1.28	1.14	1.49	.....
1875	....	30	28	34.0	31	....	.....	0.88	1.45	1.67	1.24	.....
1876	....	32	31	35.0	29	....	.....	4.35	4.00	3.45	3.18	.....
1877	....	29	27	32.4	34	....	.....	3.91	4.53	3.76	1.26	.....
1878	....	48	45	50.1	48	....	....	2.21	2.44	3.78	3.09	.....
1879	40	40	37	42.2	41	....	1.68	1.80	1.20	1.71	2.17	.....
1880	37	37	36	40.3	36	....	0.70	2.68	2.55	1.83	0.50	.....
1881	29	29	30	33.9	28	....	1.78	3.33	3.78	2.42	0.72	.....
1882	38	40	37	42 1	40	....	2.28	2.90	1.49	3.30	0.79	....
1883	33	35	31	35.7	35	....	0.57	0.73	0.32	1.07	0.52	.....
1884	35	36	32	37.2	35	....	2.24	3.27	3.45	3.37	4.91	.....
1885	34	34	30	35.2	36	....	0.04	0.17	0.41	0.17	0.33	.....
1886	35	33	31	37.4	32	....	1.41	3.08	4.32	2.25	1.31	.....
1887	36	34	32	39.9	38	....	1.79	0.77	1.80	0.76	0.48	.....
1888	29	30	27	25.0	29	....	3.09	2.70	3.44	3.45	3.25	.....
1889	39	39	39	43.0	40	....	0.11	1.76	0.30	1.04	0.53	.....
1890	30	30	28	32.6	33	28.4	0.91	2.34	1.68	2.43	1.35	2.12
1891	29	29	28	31.1	29	25.0	2.25	1.68	2.69	2.27	2.26	2.01
1892	34	34	31	36.2	34	31.8	2.47	3.06	1.91	2.91	2.74	1.16
1893	33	34	32	36.6	34	29.1	1.15	2.25	2.52	2.66	1.29	1.43
Means	34.1	35	35	37.9	35.2	28.6	1.50	2.18	2.31	2.17	1.55	1.68

SUMMARY OF WEATHER CONDITIONS.

BAROMETER—Mean pressure for the month, 30.04 inches. Highest observed, 30.75, at Clarinda on the 15th. Lowest observed, 29.14, at Davenport on the 8th. Greatest range, 1.45, at Clarinda. Range for the State, 1.61 inches.

TEMPERATURE—Monthly mean, 31.8°; highest monthly mean, 39.8°, at Ft. Madison; lowest monthly mean, 23.8°, at Osage. The highest temperature reported was 84°, at Glenwood on the 30th. The lowest temperature reported was −8°, at Alta and Eagle Grove on the 4th. Average daily maximum, 41.6°; average daily minimum, 22.5°; average monthly maximum, 70.1°; average monthly minimum, 0.2°. Greatest local monthly range, 84°, at Bonaparte. Least local monthly range, 60°, at Dubuque. Range for the State, 92°. Average monthly range, 70°.

PRECIPITATION—Average for the State, 2.14. The greatest amount reported, 4.40, at Fulton. The least amount reported, 0.64, at Denison. Average number of days on which .01 inch or more fell, 7.5.

MISCELLANEOUS—Average number of cloudy days, 11.4; partly cloudy, 10.6; clear, 8.7.

Lightning at Alta on 12th and 22d.

Thunder storms occurred quite generally throughout the State on the 10th, 22d and 23d.

Solar halos at Alta, 3d; Ames, 3d; Amana, 29th; Cresco, 5th and 26th; Webster City, 3d.

Lunar halos at Alta, 3d; Ames, 1st, 3d and 27th; Amana, 3d and 29th; Webster City, 3d.

Hail at Blakeville, 22d; Cresco, 14th; Iowa Falls, 10th

High wind at Delaware on 22d.

Sleet at Independence on 22d.

ATMOSPHERIC PRESSURE.

STATIONS.	Mean actual barometer.	Mean reduced barometer.	EXTREMES.			
			Highest barometer	Date.	Lowest barometer	Date.
Clarinda	.....	30.05	30.75	15	29.30	8
Cresco	.....	.....	30.70	15	29.45	11
Davenport	.....	30.01	30.56	15	29.14	8
Des Moines	29.07	30.05	30.72	15	29.32	8
Dubuque	.....	30.03	30.59	15	29.27	8
Keokuk	29.35	30.04	30.62	15	29.26	8
Omaha, Neb	.....	30.07	30.74	15	29.41	8
Sioux City	.....	30.04	30.74	15	29.34	10
Means	29.21	30.04	30.75	15	29.14	8

WIND MOVEMENT.

STATIONS.	Miles.	Maximum velocity.	Direction.	Date.
Davenport	9,444	44	NE	22
Des Moines	7,729	38	SW	10
Dubuque	4,892	26	E	22
Keokuk	6,437	34	W	11
La Crosse	5,510	36	N	14
Omaha	7,210	34	NW	13
Sioux City	9,240	44	NW	11

OBSERVERS' NOTES.

Clinton—DR. LUKE ROBERTS: Before proceeding with March weather record, I wish to correct an error which, unaccountably, was made in February's report, and was not observed until several days after it was in print. The first paragraph following the table of season comparisons, read: "By the above table it will be seen that the coldest winter was that of 1884–85, a mean of 8.9° below that of the winter just closed. Seven other winters were colder than 1892–93, which will be seen by the table." It should have read: "By the above table it will be seen that but one other winter was colder than that of 1892–93, viz: 1884–85, the mean temperature of which was only 2.3° below that of the winter of 1892–93.

March, 1893, was nearly barren of any meteorological phenomena. The movement of the wind was below normal by 810 miles. The maximum velocity was 25 miles an hour. The prevailing direction was northeast, the west wind being nearly the same in frequency. There were only six storm days, and the precipitation was principally rain; a little snow on the 17th, but not a measurable amount. On the night of the 18th–19th, two and a half inches fell, but disappeared in a few hours. Total fall of water for the month, two and three-fourths inches. This was slightly in excess of a March average. The principal storm was from 10 P. M. of the 21st to 6 P. M. of the 22d. Total precipitation, .99 of an inch.

The mean temperature of the air for the month was 33.1°, being one degree above a mean for the last fifteen years. The maximum temperature was 70°, occurring on the 31st. This was also the warmest day of the month, the mean of which was 57.5°.

The maximum temperature was exceeded by one degree in March, 1886 and 1887, and two degrees in 1889. The minimum temperature for March, 1893, was 5°. During the last thirteen corresponding months the temperature dropped below zero 10° in 1884, and in 1890 19° below. It was also below in 1885, 1886, 1887, 1888 and 1891. Forty-eight per cent marked the shading of the sky, giving twelve cloudy, eight clear, and eleven fair days.

Ames—ISAAC YOUNG: Wild geese were going west on the 7th. First robins heard on the 9th.

Belle Plaine—H. M. VANDIKE: Robins were first heard on the 2d, bluebirds on the 9th and wild geese on the 10th.

College Springs—A. A. BERRY: The first thunderstorm of the season took place on the 7th, accompanied by 0.22 inch of rain. Everything prosperous for the farmers. Fall wheat looking well. The snow storm on the morning of the 27th was light compared with what it was a few miles north of us.

Cedar Rapids—H. D. OLDS: At close of the month frost was out of the ground, and the weather was extremely favorable for plowing and early seeding.

Denison—PH. SCHLUMBERGER: Wild geese were first seen on the 9th; robins and bluebirds on the 10th.

SOLAR OBSERVATIONS, MARCH, 1893.—ALTA, IOWA.

BY DAVID E. HADDEN.

Date.	CENTRAL TIME.	NUMBER VISIBLE		Faculæ.	Definition.	REMARKS.
		Groups.	Spots.			
1	5:10 P. M.	7	44	3	Good..	Two groups are disappearing by solar rotation. Extended group of small spots NE.
2	5:10 P. M.	6	*25	4	Fair...	Air unsteady. The large group S. has divided into two.
3	5:00 P. M.	7	....	.....	Poor ..	New group by rotation on SE. limb.
4	5:15 P. M.	7	*35	4	Fair...	Large faculæ by rotation near yesterday's group. Also new faculæ one day in E. limb. The large group SW. is decreasing in size. Other groups small.
6	5:15 P. M.	4	15	3	Fair...	Groups mostly small.
7	11:45 A. M.	5	.....	1	Poor ..	Hazy. Group of small spots near meridian S. latitude.
9	11:45 A. M.	8	.....	3	Fair...	Fairly large group by rotation on E. limb. The larger spot with umbra and penumbra is just on edge of limb. The other groups are all small and all scattered over disc in both N. and S. hemispheres.
10	5:15 P. M.	4	....	4	Poor .	The smaller groups seem to have disappeared, but two N. and one S. being visible. Three groups of faculæ are W.; one E.
12	4:00 P. M.	3	20	4	Good..	The large group E. has one large round spot with umbra and penumbra. Extensive faculæ extends from this group to the E. limb in which a new small group is just appearing by rotation. The other group is small W. of meridian. Faculæ along E. and W. limbs.

SOLAR OBSERVATIONS, MARCH, 1893—CONTINUED.

BY DAVID E. HADDEN.

Date.	CENTRAL TIME.	NUMBER VISIBLE		Faculæ.	Definition.	REMARKS.
		Groups.	Spots.			
14	5:15 P. M.	4	.....	5	Poor ..	Hazy. Area of facula by rotation.
15	11:30 A. M.	3	28	4	Fair...	The large spot is about on Sun's center.
17	5:15 P. M.	3	6	2	Good..	The large spot is W. of meridian. A new group is on E. limb; also a new group near it about one day in. Faculæ NE.
20	5:20 P. M.	8	24	3	Good..	The large group is near W. limb. A large group is one day in by rotation E. limb. A train of four groups near E. limb. Extensive faculæ SE. "Veiled" group near meridian S. latitude. Very faint small group W. of meridian.
25	11:40 A. M.	5	48	3	Good..	A large double spot NW. with many small spots. A new group is in facula about one day in with new spots on limb to-day. Large area of facula just on SE. limb by rotation.
27	11:30 A. M.	7	.....	.....	Bad....	New group by rotation. Large spot is in high W. latitude.
28	11:30 A. M.	9	34	4	Good..	New small groups in NE and NW. quadrants. Six groups are N. of equator. Large spot is NW.
30	11:20 A. M.	10	51	3	Fair...	Could not count spots accurately. A new small group is in group of faculæ NE. limb one day in; also another new group on edge of limb. An extensive group of small spots is about on meridian in S. latitude.

* About.

METEOROLOGICAL DATA FOR MARCH, 1893.

STATIONS.	TEMPERATURE OF THE AIR (IN DEGREES FAHRENHEIT).								PRECIPITATION IN INCHES.									
	Monthly mean.	EXTREMES. Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Monthly range.	Monthly, including melted snow.	Total monthly snowfall.	Depth of unmelted snow at end of month.	Prevailing direction of wind.	No. of rainy days. (.01 inch or more).	No. of cloudy days.	No. of fair days.	No. of clear days.	No. of hail-storms.	No. of thunder-storms.
Algona	28.4	66	31	.....	-4	4	.....	70	2.20	8.0	.....	.....	6	8	17	6	..	2
Alta	26.7	61	31	35.7	-8	4	17.6	69	2.60	6.0	.....	NW.	9	14	11	6	1	2
Ames (W. R. Cooper)	30.1	73	31	42.8	-5	5	17.3	78	2.04	2.7	.....	NW.	9	12	10	9	..	..
Ames (E. S. King)	.....	.....	.....	.....	.....	.....	.....	.....	2.10	.....	.....	.....	9	.....	.....	.....	.....	.....
Ames (four miles SW of)	31.1	70	31	.....	-4	4	.....	74	1.73	2.2	.....	NW.	5	13	4	3	..	1
Amana	32.3	71	31	40.4	3	4	24.2	68	2.52	2.0	.....	NW.	9	10	15	6	..	2
Atlantic	32.7	74	30	45.2	-3	1	20.3	77	1.58	6.2	.....	NW.	6	14	6	11	..	1
Audubon	31 0	75	30	41.8	-3	4	20.2	78	1 55	1.0	.....	.....	6	12	16	3	1	2
Belle Plaine	31.7	73	31	40.5	2	4	22.9	71	2.49	4.5	.....	NW.	9	16	8	7	..	..
Blakeville	29.8	.....	.....	.....	.....	.....	.....	.....	3.54	11.0	.....	NW.	9	11	14	6	1	2
Blockton	33.8	73	31	45.9	2	3	21.5	71	1.50	.....	.....	.....	2	.....	.....	.....	..	2
Bonaparte	36.0	79	31	46.6	-5	4	25.3	84	2.79	.....	.....	NW.	5	.....	.....	.....	..	..
Carroll	30.1	67	31	39.2	-2	4	21.0	69	1.75	.....	.....	.....	5	16	8	7	..	1
Cedar Falls	31.1	67	31	40.1	2	4	22.1	65	2.78	0.7	.....	NW.	5	18	2	11	..	1
Cedar Rapids	33.1	68	31	40.0	5	4	26.1	63	2.99	3.0	.....	W	11	9	8	14	..	1
Centerville	35.8	76	31	47.2	2	4	24.3	72	1.10	1.0	.....	W.	3	12	13	6	..	1
Charles City	26.5	62	31	34.8	-12	6	18.2	74	2.51	7.8	.....	NW.	7	.....	.....	.....	..	..
Clarinda	33.0	74	31	43.2	2	4	22.9	70	1.73	6.0	.....	NW.	7	14	3	14	..	1
Clinton	34.0	70	31	44.0	5	4	24.0	65	2.75	2.5	.....	NE.	6	9	16	6	..	..
College Springs	33.7	79	31	44.2	0	3	23.2	79	1.80	5.5	.....	NW.	5	11	6	14	..	..
Corning	33.2	74	31	43 9	0	4	22.5	74	2.31	9.8	.....	NW.	7	11	12	8	..	1
Davenport	34.0	74	31	41.6	6	4	26.9	68	2.25	.....	.....	W.	12	16	9	6	..	1
Delaware	37.8	65	31	.....	0	4	.....	65	2.31	4.3	.....	SW.	9	11	8	12	..	2
Denison	31.9	69	31	43.2	-2	4	20.6	71	0.64	.....	.....	NW.	9	16	11	4	..	1
Des Moines	33.0	74	31	42.4	1	4	24.4	73	1.15	7.2	.....	NW.	7	8	16	7	..	..
Dubuque	32.0	65	31	3.89	5	4	24 2	60	2.52	.....	.....	SE.	9	12	10	9	..	..
Eagle Grove	25.1	54	30	30.9	-8	4	19.3	62	2.37	3.7	.....	S.	5	11	5	14	..	..
Elkader	31.2	67	30	42.1	-4	5	20.4	71	2.15	5.0	.....	S.	9	9	6	16	..	4
Ft. Madison	39.8	70	31	.....	9	4	.....	61	3.98	0.7	.....	SE.	8	16	12	3	1	1
Fulton	32.3	.....	.....	.....	.....	.....	.....	.....	4.40	3.0	.....	NE.	4	1	12	18	..	..
Glenwood	37.9	84	30	51.2	2	4	24.6	82	0.97	5.0	.....	NW.	4	4	19	8	1	..
Grand Meadow	28.9	.....	.....	.....	.....	.....	.....	.....	2.29	7.2	.....	.....	11	.....	.....	.....	..	1
Greenfield	32.4	73	31	43.4	-2	4	26.8	75	1.96	3.2	.....	SW.	12	9	10	12	..	1
Grinnell	32.5	67	31	40.0	4	4	25.0	63	1.60	1.2	.....	E.	5	9	13	9	..	..
Grundy Center	29.2	65	31	37.5	0	4	20.8	65	2 40	4.2	.....	SE.	12	10	13	8	..	..
Hampton	26.7	65	31	35.3	-4	4	18.1	69	2.56	3.4	.....	NE.	11	9	14	8	1	1
Hawkeye	.....	.....	.....	.....	.....	.....	.....	.....	1.95	.....	.....	.....	4	.....	.....	.....	.....	.....
Hopeville	33.8	71	31	43.4	1	4	24.3	70	0.63	1.5	.....	NW.	10	9	16	6	..	3
Hopkinton	32.8	68	31	.....	5	4	.....	63	2.81	7.0	.....	.....	8	.....	.....	.....	..	1
Independence	30.9	67	31	41.3	-2	4	20.5	69	1.75	4.5	.....	SE.	6	9	13	9	2	..
Indianola	35.0	74	31	45.5	2	4	24.4	72	0.80	0.2	.....	NW.	7	15	15	1	..	..
Iowa City	34.6	72	31	45.2	4	4	24.0	68	2.82	2.5	.....	NW.	8	17	2	12	..	2
Iowa Falls	26.7	65	31	35.6	-6	4	17.8	71	2.22	6.0	.....	NE, S	7	13	6	12	1	..
Jefferson	30.8	73	31	43.0	-6	4	18.2	79	.....	.....	.....	.....	..	6	15	10	..	..
Keokuk	36.6	78	31	44.8	6	4	28.5	72	2.66	.....	.....	W.	6	10	14	7	..	..
Keosauqua	36.8	71	31	46.7	6	4	26.9	65	2.35	.....	.....	.....	4	.....	.....	.....	..	1
Larrabee	26.9	62	30	37.5	-7	4	16.2	69	2.47	9.5	.....	.....	9	3	19	9	1	..
Logan	31.1	73	31	39.9	0	4	22.3	73	0.84	.....	.....	N.	4	16	6	9	..	..
Marshalltown	32.9	70	31	41.9	1	4	24.0	69	1.97	3.2	.....	S.	6	11	7	13	..	..
Maxon	32.6	.....	.....	.....	.....	.....	.....	.....	2.56	0.5	.....	.....	10	7	20	4	..	1
Mechanicsville	31.4	69	31	38.7	2	5	23.0	67	2.79	5.8	.....	E.	12	13	10	8	..	1
Monticello	29.4	68	31	37.6	-4	4	21.7	72	2.44	.....	.....	NW.	11	9	12	10	..	1
Mt. Vernon	32.7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Mt. Ayr	34.8	70	31	45.8	3	4	2.73	67	2.13	.....	.....	NE.	7	14	6	11	..	..
Murray	33.7	72	31	43.2	1	4	24.2	71	0.94	1.4	.....	NW.	9	15	10	6	..	3
Newton	33.5	75	31	43.7	1	4	23.4	74	1.33	3.1	.....	E.	9	14	4	13	..	..
Omaha	34.0	73	30	41.9	4	4	25.2	69	1.29	.....	.....	NW.	13	8	11	12	..	..
Osage	23.8	.....	.....	.....	.....	.....	.....	.....	2.46	7.0	.....	SE.	9	16	9	6	..	3
Oskaloosa	34.0	74	31	43.7	4	4	24.4	70	1.90	1.8	.....	SW.	7	19	1	11	..	..
Panama	30.3	70	30	39.7	2	4	21.0	68	1.10	0.7	.....	NW.	4	16	4	11	..	..
Richland	32.3	.....	.....	.....	.....	.....	.....	.....	3.03	0.8	.....	.....	6	8	21	2	..	1
Sioux City	29.1	67	31	38.6	4	15	20.2	63	1.43	.....	.....	NW.	9	13	11	7	..	..
Storm Lake	27.4	59	30	36.9	5	4	17.9	54	2.60	5.0	.....	NW.	9	7	19	5	1	3
Tipton	33.8	77	31	43.4	2	4	24.0	75	3 77	4.0	.....	NW.	11	9	11	11	..	..
Villisca	33.5	70	31	44.9	2	4	22.2	68	3.09	.....	.....	SE.	7	.....	.....	.....	.....	.....
Vinton	31.2	69	31	.....	1	4	.....	68	1.95	1.5	.....	NW.	4	9	10	12	..	1
Washington	36.6	75	31	34.3	6	4	28.8	69	2.70	2.0	.....	NW.	6	.....	.....	.....	.....	.....
Webster City	28.2	72	31	.....	-4	4	.....	76	1.18	2.5	.....	SE.	4	4	14	13	..	..
Williams	27.4	65	31	.....	-5	4	.....	70	1.89	.....	.....	E.	10	9	12	10	..	..
Winterset	33.2	75	31	43.3	0	4	24.1	75	1.85	.....	.....	S.	5	19	6	6	..	..
Monthly mean	31.8	84	30	41.6	-8	4	22.5	70	2.14	4.0	.....	NW.	7.5	11.4	10.6	8.7	11	53

DAILY AND MONTHLY MEAN TEMPERATURE FOR MARCH, 1893.

STATIONS.	DATE.																													Monthly Mean.
	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	31st.	
Algona	20	14	5	10	8	22	28	34	38	44	36	36	32	8	12	22	18	26	30	36	35	35	35	34	38	36	49	48	52	28.4
Alta	17	20	5	5	11	22	27	32	38	44	34	35	24	12	9	19	20	18	20	35	25	29	31	24	24	31	36	37	45	46	50	26.7
Ames (W. R. Cooper)	22	20	12	8	12	22	26	48	39	47	43	40	38	18	12	22	20	19	24	26	34	28	48	32	28	30	36	35	42	48	54	30.1
Ames (4 miles SW of)	28	26	5	14	18	32	34	37	38	48	37	42	28	14	14	20	16	26	29	39	30	32	45	26	28	32	33	38	48	52	54	31.1
Amana	28	30	9	14	19	28	36	40	40	47	38	40	37	17	16	23	24	26	30	36	32	34	48	30	32	34	34	36	40	48	58	32.3
Atlantic	20	30	14	14	21	34	35	40	40	49	38	42	36	19	18	24	22	28	32	42	30	34	40	27	28	36	38	38	46	52	59	32.7
Audubon	23	23	10	10	18	26	32	37	39	48	38	39	32	15	16	22	22	19	28	46	30	32	40	26	26	34	38	38	45	55	56	31.0
Belle Plaine	26	29	11	12	18	26	35	38	38	47	37	39	33	18	14	23	24	24	28	36	32	34	49	28	31	36	35	32	41	50	58	31.7
Blakeville	26	18	10	11	17	29	31	36	35	46	39	36	28	14	15	21	24	24	32	50	31	31	46	30	30	32	34	37	42	48	47	29.8
Blockton	27	34	19	14	27	34	34	42	45	50	44	41	35	18	15	18	18	20	36	43	33	42	48	32	28	35	38	28	40	52	59	33.8
Bonaparte	32	37	20	17	27	36	39	44	40	47	44	42	41	24	20	32	27	26	36	37	36	37	54	38	32	34	35	37	41	55	62	36.0
Carroll	32	26	14	11	11	21	31	34	38	45	39	42	31	20	14	16	21	22	24	24	40	34	41	29	31	28	33	34	50	52	55	30.1
Cedar Falls	23	26	15	12	20	22	29	37	38	46	44	37	34	16	17	15	27	23	27	35	33	32	46	29	32	33	40	40	41	45	49	31.0
Cedar Rapids	26	26	16	16	20	28	31	40	42	48	38	41	30	24	18	22	26	26	29	34	36	33	49	30	32	39	34	32	43	50	58	33.1
Centerville	29	38	21	15	26	36	38	41	41	50	46	40	40	23	17	21	24	23	34	43	45	41	50	33	28	35	35	34	40	56	63	35.8
Charles City	14	17	2	4	12	9	20	36	38	41	35	34	30	13	9	16	21	20	24	36	27	32	42	30	37	30	32	30	43	46	50	26.5
Clarinda	30	30	11	14	28	34	36	40	40	50	40	44	34	16	16	20	20	22	34	34	32	36	43	26	27	41	35	36	44	55	58	33.0
Clinton	26	31	20	16	18	26	35	38	40	48	44	41	46	24	18	22	28	26	35	36	35	34	50	42	31	30	32	38	38	52	54	34.4
College Springs	34	32	12	12	25	36	36	42	42	50	39	44	38	18	19	22	18	18	40	42	33	38	48	30	29	35	29	34	45	56	62	33.7
Corning	26	34	14	13	...	35	34	40	40	50	36	42	36	19	16	21	24	30	42	42	31	34	40	27	26	34	34	29	42	54	62	33.2
Cresco	16	21	0	6	8	12	24	32	36	38	33	31	28	10	6	16	16	17	26	33	25	26	38	20	24	27	32	32	38	42	47	25.0
Davenport	30	34	12	16	22	31	38	40	40	50	38	42	44	19	18	22	28	27	34	36	36	34	50	30	32	35	34	38	40	54	58	34.0
Decorah	15	14	5	14	10	7	30	32	32	40	35	35	24	23	14	18	22	23	33	38	38	35	42	28	30	32	32	37	44	48	48	28.2
Delaware	21	23	3	7	11	18	27	36	37	43	34	34	37	14	12	20	21	24	28	33	30	30	46	29	29	30	30	34	40	43	51	27.8
Denison	23	26	16	12	15	26	35	35	40	49	39	48	32	18	15	26	22	29	26	41	30	32	36	26	26	36	40	42	60	49	55	31.9
Des Moines	30	34	8	13	24	32	35	42	40	51	38	42	34	18	16	21	24	32	30	42	32	34	50	28	29	36	36	37	43	52	62	33.4
Dubuque	28	28	10	14	19	21	35	37	39	45	36	40	28	18	14	22	26	26	33	34	32	32	48	32	31	32	31	36	42	51	52	32.0
Eagle Grove	13	14	3	2	9	13	22	35	36	43	35	35	28	7	6	19	16	18	24	37	31	31	34	20	30	29	32	34	42	44	45	25.1
Elkader	23	24	8	14	15	17	32	34	38	45	36	40	40	18	17	20	28	25	36	41	32	30	48	31	34	34	36	38	40	50	52	31.2
Ft. Madison	38	39	20	24	34	41	46	50	45	52	44	46	50	28	29	24	51	32	36	41	43	41	57	33	37	38	36	40	48	54	54	39.5
Fulton	24	28	8	14	16	25	34	36	40	48	37	40	37	18	15	24	26	30	32	34	38	32	54	32	31	32	34	34	43	50	56	32.3
Glenwood	33	37	15	16	33	36	43	42	56	60	42	48	38	17	15	24	24	21	38	48	45	35	39	28	34	36	42	48	53	63	67	37.9
Grand Meadow	24	21	4	10	14	22	30	37	38	44	35	35	34	13	11	20	22	27	25	32	30	30	46	31	28	28	33	34	42	48	49	28.9
Greenfield	25	28	9	11	22	32	37	42	40	47	40	42	33	18	15	21	20	20	31	42	32	30	49	30	29	30	38	35	43	54	60	32.5
Grinnell	28	30	16	14	20	30	34	39	34	48	46	40	35	22	14	21	22	26	28	37	32	32	44	40	28	32	32	34	42	50	56	32.5
Grundy Center	24	17	7	10	17	25	28	32	38	44	37	39	27	12	11	22	20	24	30	36	34	32	33	29	30	34	34	36	42	48	54	29.2
Hampton	20	20	2	6	12	18	24	34	35	41	34	34	28	12	8	18	20	18	27	35	27	30	43	28	26	30	33	32	36	44	50	26.7
Hopeville	30	34	14	14	27	34	37	43	38	50	39	42	33	20	16	22	21	22	34	42	33	36	47	28	29	36	36	34	41	56	60	33.8
Hopkinton	26	27	12	14	18	21	34	38	39	44	37	38	44	20	17	22	24	27	32	37	34	32	49	42	32	34	35	38	44	49	55	32.8
Independence	24	25	4	9	14	20	30	36	37	46	45	38	38	20	14	20	24	23	30	53	32	32	48	40	30	32	34	36	41	48	52	30.9
Indianola	31	34	17	14	19	33	36	43	41	50	50	43	...	...	11	21	22	28	31	42	32	35	50	38	28	35	36	33	44	54	63	35.0
Iowa City	30	30	22	16	22	28	37	40	47	45	41	42	23	14	22	27	27	36	36	35	27	50	44	...	33	36	36	38	40	50	57	34.6
Iowa Falls	20	16	0	7	9	13	26	34	35	42	34	34	28	11	8	19	19	19	27	36	27	30	43	28	26	30	34	32	41	46	52	26.7
Jefferson	21	24	16	8	20	20	27	40	38	44	46	33	38	21	11	19	20	24	21	38	35	32	45	36	22	33	41	33	44	49	56	30.8
Keokuk	35	40	16	18	29	38	41	45	42	50	40	44	45	22	19	22	27	28	36	40	36	38	54	30	32	34	34	37	43	57	65	36.6
Keosauqua	33	36	22	18	28	34	35	45	43	48	46	42	40	24	...	22	28	27	36	34	36	38	50	43	32	36	35	37	42	56	59	36.8
La Crosse, Wis	24	22	6	13	14	16	30	34	40	43	38	37	34	16	13	17	24	24	28	53	27	28	38	32	26	28	34	33	40	45	50	29.0
Larrabee	18	14	5	8	12	21	24	33	40	45	35	36	26	16	10	20	16	20	30	38	36	32	36	26	28	22	40	46	49	56	60	31.1
Logan	22	18	14	10	22	26	34	38	40	50	42	44	33	12	15	20	18	19	30	38	36	32	36	26	28	22	31	36	38	46	48	26.9
Maquoketa	22	27	7	14	20	25	34	39	39	48	40	41	39	16	16	24	20	26	32	33	35	33	54	32	31	34	34	37	38	47	48	31.8
Marshalltown	24	30	18	8	19	22	34	38	36	48	47	40	46	28	12	22	22	25	32	34	33	40	45	44	30	33	36	36	46	56	56	33.0
Maxon	28	31	4	12	25	36	37	44	38	52	36	42	32	14	16	20	21	25	36	36	32	34	50	27	29	32	30	31	46	54	58	32.6
Mechanicsville	26	28	9	12	19	26	34	34	39	46	36	38	40	16	16	21	24	27	30	34	32	31	52	29	30	36	30	34	39	50	51	31.4
Monticello	32	24	4	4	14	26	31	39	37	45	36	37	33	15	13	22	20	28	28	32	32	31	49	29	30	30	30	30	40	48	51	29.4
Mt. Vernon	27	35	5	12	23	33	37	40	40	51	37	40	35	14	14	22	23	28	33	35	35	34	55	29	33	38	30	36	44	52	53	32.7
Mt. Ayr	30	39	14	16	30	28	40	42	42	50	40	43	36	24	19	19	22	23	24	44	34	36	48	28	32	36	34	38	40	56	61	34.8
Murray	30	34	9	14	26	34	26	32	40	49	38	42	32	20	17	22	24	22	33	42	33	36	47	28	29	36	36	35	44	54	60	33.7
Newton	28	30	18	12	20	30	34	40	39	50	46	42	37	20	14	22	24	22	29	38	33	34	50	39	29	35	34	36	42	52	60	33.5
Omaha, Neb	30	30	10	16	26	34	38	40	44	52	40	47	28	14	16	22	21	22	31	42	34	36	37	25	26	36	34	40	51	58	60	34.0
Osage	14	14	1	4	4	12	20	36	36	40	34	30	28	10	4	18	16	18	22	33	25	30	36	29	22	25	29	30	40	42	42	23.8
Oskaloosa	30	34	17	16	24	34	36	43	38	48	44	41	34	21	17	22	24	24	34	38	32	34	50	34	30	34	34	36	42	53	60	34.0
Panama	20	32	11	10	16	28	34	36	40	48	36	42	32	12	14	22	19	18	26	38	33	32	35	24	24	34	37	40	46	53	56	30.3
Richland	27	30	8	12	28	26	38	42	38	42	40	41	32	18	16	19	24	30	33	33	34	34	52	29	30	32	30	34	45	52	53	32.3
Sioux City	22	24	8	12	16	25	32	36	42	48	37	43	24	9	10	21	18	20	21	38	28	30	30	22	20	33	36	39	49	40	56	29.1
Storm Lake	20	19	9	9	10	21	33	38	43	40	36	21	30	14	10	20	20	18	22	36	29	30	28	28	23	30	36	38	42	46	49	27.4
Tipton	29	30	14	14	22	28	30	37	37	42	44	41	41	20	17	22	26	26	32	35	34	32	48	40	30	36	33	36	42	52	62	33 8
Villisca	32	36	28	16	18	30	38	40	42	39	40	40	48	26	20	22	22	19	26	39	46	37	42	40	28	28	41	35	38	46	56	...
Vinton	28	25	7	13	18	30	34	39	38	48	37	38	31	14	16	22	23	27	31	34	32	33	51	29	31	31	32	35	34	50	51	31.2
Washington	32	38	11	14	29	34	38	44	43	51	43	48	43	21	17	26	28	26	39	38	39	36	59	34	35	33	34	35	44	57	64	36.6
Webster City	23	18	4	6	12	24	33	37	38	40	40	41	26	10	13	20	18	26	32	34	28	30	24	25	23	33	34	33	38	52	52	28 2
Williams	23	17	3	5	9	22	33	35	36	40	33	35	26	9	10	24	18	24	27	33	32	32	37	26	26	32	32	34	43	47	56	27.4
Winterset	29	33	9	12	24	32	38	41	39	50	38	41	32	20	16	21	23	21	30	46	31	34	54	26	30	31	37	36	41	53	63	33.2

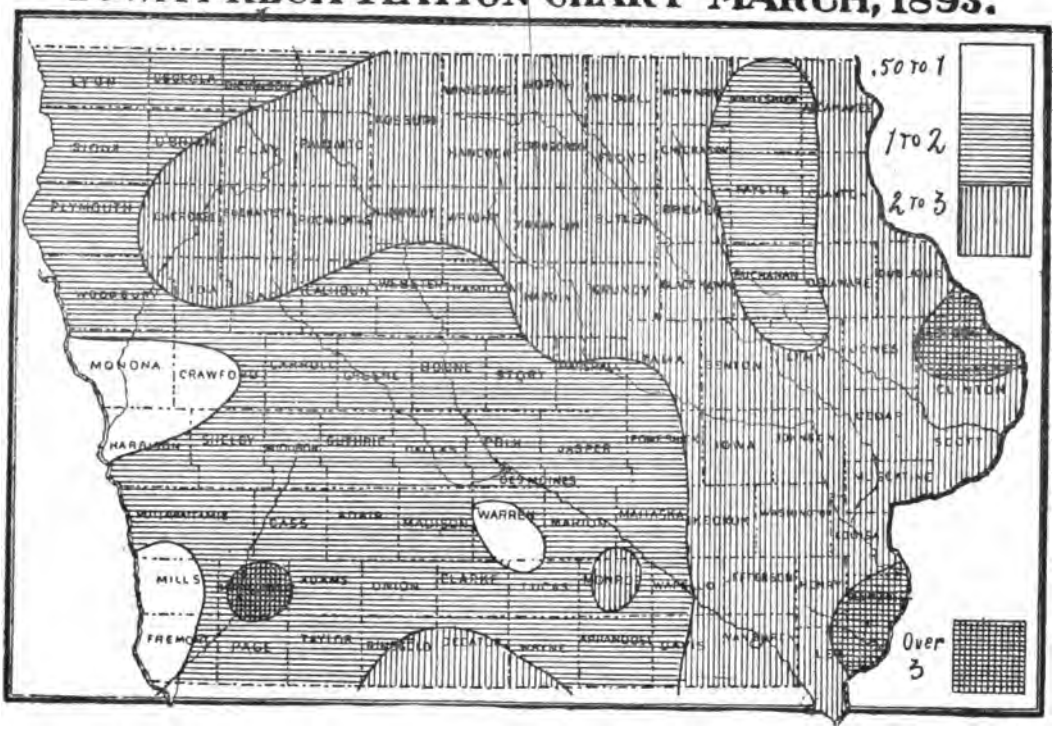
DAILY AND MONTHLY PRECIPITATION FOR MARCH, 1893.

STATIONS.	DATE.																															Total.
	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th	27th.	28th.	29th.	30th.	31st.	
Algona	....	....	....	....	....	....	....	....	0.70	0..5	....	....	0.20	....	....	0.10	....	....	T	....	....	....	1.10	0.05	....	....	....	....	....	....	....	....	2 20
Alta (David E. Hadden)	....	....	....	....	....	....	....	1.42	....	T	0.06	....	0.05	....	....	0.07	T	T	....	....	....	0.47	0.38	0.15	....	....	....	....	....	....	....	2.60
Ames (W. B. Cooper)	....	....	....	....	....	....	....	0.80	....	....	0.05	....	....	0.03	....	0.15	....	0.15	....	0.04	..	0.35	0.45	0.02	....	....	....	....	....	....	....	2.04
Ames (E. S. King)	....	....	....	....	....	....	....	0.90	....	....	0.05	....	....	0.03	....	0.15	....	0.15	....	0.04	....	0.32	0.44	0.02	....	....	....	....	....	....	....	2.10
Amana	....	T	....	....	....	....	....	0.82	0.57	....	0.06	....	....	T	....	....	0.07	....	0.11	0.07	0.20	0.59	0.03	....	....	....	....	....	....	....	....	2.53
Atlantic	....	....	....	....	....	....	....	0.23	....	T	....	....	....	....	....	0.12	....	....	....	0.04	0.10	....	0.59	T	....	T	0.50	....	....	....	....	1.58
Audubon	....	....	....	....	....	....	....	0.48	0.08	0.08	....	....	....	....	....	0.10	....	....	....	....	....	0.18	0.63	....	....	....	....	....	....	....	....	1.55
Belle Plaine	....	T	....	....	....	....	....	1.08	....	0.19	0.03	....	T	0.05	..	0.08	....	0.20	....	0.41	....	0.41	....	0.04	T	....	....	....	....	....	....	2.49
Blakeville	....	0.05	....	....	....	....	....	2.20	....	0.04	....	....	0.10	....	....	0.10	....	0.20	....	0.25	0.35	0.15	....	0.10	....	....	....	....	....	....	....	3.54
Blockton	....	....	....	....	....	....	....	0.40	....	....	....	....	....	....	....	....	....	....	....	....	....	1.10	....	....	....	....	....	....	....	....	....	1.50
Bonaparte	....	....	....	....	....	....	0.50	1.09	....	....	....	....	....	....	....	....	....	....	....	0.33	0.78	0.09	....	....	....	....	....	....	....	....	....	2.79
Carroll	....	....	....	....	....	....	....	....	0.24	....	0.06	....	....	....	....	....	....	....	....	....	....	0.05	....	1.40	T	....	....	....	....	....	....	1.75
Cedar Falls	....	....	....	....	....	....	....	1.40	....	0.10	....	....	T	....	....	....	....	....	0.05	T	0.20	1.03	T	T	....	....	....	....	....	....	....	2.78
Cedar Rapids	T	....	....	....	....	....	....	0.64	0.71	0.02	0.02	0.04	....	0.03	....	....	0.02	..	0.45	0.51	....	0.20	0.35	T	T	....	....	....	....	....	....	2.99
Centerville	....	T	T	....	....	....	....	....	0.35	....	T	....	....	0.10	....	....	T	....	....	T	....	0.65	T	T	T	T	T	....	....	....	....	1.10
Charles City	....	0.05	....	....	....	....	....	1.24	....	0.06	....	....	0.25	....	....	....	....	0.16	....	....	....	0.33	....	0.42	....	....	....	....	....	....	....	2.63
Clarinda	....	....	0.10	....	....	....	0.18	....	....	....	....	....	....	....	....	0.10	T	....	....	0 08	....	0.08	0.75	T	....	....	0.44	....	....	....	....	1.73
Clinton	....	0.06	....	....	....	....	....	0.94	....	....	....	....	....	....	....	....	....	....	0.20	0.48	....	0.99	0.08	....	....	....	....	....	....	....	....	2.75
College Springs	....	....	....	....	....	....	0.22	....	....	....	....	....	....	....	....	0.22	....	....	....	T	0.04	0.91	T	....	....	....	0.41	....	....	....	....	1.80
Corning	....	T	0.07	....	....	....	T	0.16	....	T	....	T	T	....	....	0.05	0.05	....	....	....	T	0.40	0.78	T	....	....	0.80	....	....	....	....	2.31
Cresco	....	0.05	....	....	....	....	....	0.64	....	0.42	T	....	0.33	....	....	T	....	....	T	0.14	0.15	1.02	....	0.02	....	....	....	....	....	....	....	2.77
Davenport	....	0.05	....	....	....	....	....	0.83	0.07	....	T	....	....	0.04	....	0.01	0.02	....	0.14	0.42	....	0.52	0.01	0.09	0.05	....	....	....	....	....	....	2.25
Decorah	....	....	....	....	....	....	0.07	....	....	0.04	....	....	....	....	....	....	....	....	....	....	....	0.09	....	....	....	....	....	....	....	....	....	0.20
Delaware	....	....	....	....	....	....	....	0.99	....	0.05	0.01	....	....	....	....	....	0.01	0.15	....	0.37	0.30	0.37	....	0.06	....	....	....	....	....	....	....	2.31
Denison	....	....	T	....	....	0.03	....	0.06	....	....	0.17	....	0.04	....	....	0.15	....	....	....	....	....	0.07	0.12	....	....	....	....	....	....	....	....	0.64
Des Moines	....	T	T	T	....	....	....	0.49	0.05	T	T	....	T	....	....	0.15	T	....	T	0.14	T	0.15	0.16	T	T	....	....	....	....	....	....	1.15
Dubuque	....	T	T	....	....	....	....	1.04	0.05	....	T	....	....	0.12	....	....	0.01	....	0.04	0.32	....	0.34	0.03	0.08	T	....	....	....	....	....	....	2.52
Eagle Grove	....	....	....	....	....	....	....	2.00	....	....	....	....	0.10	....	....	0.05	....	....	....	....	0.20	0.02	....	....	....	....	....	....	....	....	....	2.37
Elkader	....	0.02	....	....	....	....	....	0.79	....	0.12	....	....	....	0.06	....	....	....	0.04	....	0.27	0.28	0.45	0.12	T	....	....	....	....	....	....	....	2.15
Ft. Madison	....	T	....	....	....	....	....	2 50	T	T	....	....	....	T	....	0 07	....	....	....	0.53	....	0.88	T	T	T	....	....	....	....	....	....	3.98
Fulton	....	....	....	....	....	....	....	1.30	....	....	....	....	....	....	....	....	....	....	1.20	0.50	....	1.10	....	0.30	....	....	....	....	....	....	....	4.40
Glenwood	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.30	0.03	....	....	....	....	0.60	....	....	....	....	....	0.04	....	....	....	....	0.97
Greenfield	....	....	....	....	....	....	T	0.27	0.01	0.02	0.01	....	0 02	T	....	0 06	0.03	....	....	0.17	0.03	0.18	1.02	T	....	....	0.14	....	....	....	....	1.96
Grinnell	....	....	....	....	....	....	....	0.95	T	T	T	....	....	0.14	....	0.15	....	0.06	0.30	....	....	....	....	T	T	....	....	....	....	....	....	1.60
Grundy Center	....	....	....	....	....	....	....	1.08	....	0.08	0.01	....	0.52	0.04	....	0.03	....	0.16	....	0.15	0.22	0.53	0.04	0.04	....	....	....	....	....	....	....	2.40
Hampton	....	....	....	....	....	....	....	1.20	....	0.08	0.04	....	0.12	....	....	0.08	....	0.06	....	0.10	0.28	0.52	0.05	0.03	....	....	....	....	....	....	....	2 56
Hawkeye	0.21	....	....	....	....	....	....	0.74	....	....	....	....	....	0.11	....	....	....	....	....	....	....	0.85	T	....	....	....	....	....	....	....	....	1.95
Hopeville	....	0.01	T	....	....	....	T	0.11	....	....	....	....	T	0.01	....	0.01	0.02	....	....	0.05	0.08	0.10	0.15	T	....	....	0.08	....	....	....	....	0.63
Hopkinton	....	....	....	....	....	....	....	0.90	....	0.10	....	....	....	0.08	....	....	0.08	....	....	0 45	....	0.30	0.50	Q.55	....	....	....	....	....	....	....	3.16
Independence	....	T	....	....	....	....	....	1.00	....	T	....	....	....	0.10	....	....	....	....	0.10	0 30	....	0.15	....	....	0.10	....	....	....	....	....	....	1.75
Indianola	....	....	....	....	....	....	....	0.04	0.05	0.01	T	....	....	....	....	0.01	T	....	....	0.16	T	0.39	0.14	T	T	....	....	....	....	....	....	0.80
Iowa City	....	0.03	....	....	....	....	....	1.25	....	0.03	....	....	....	....	0.05	....	0.17	....	0.38	....	0.85	....	0.06	....	....	....	....	....	....	....	....	2.82
Iowa Falls	....	0.05	....	....	....	....	....	1.07	....	....	T	....	0.11	0.10	....	....	....	....	0.10	....	0.25	0.45	....	0.09	....	....	....	....	....	....	....	2.22
Keokuk	....	T	....	....	....	....	....	1.20	0.49	T	T	....	....	T	T	....	0.05	....	....	0.34	T	0.53	0.02	T	T	....	....	....	....	....	....	2.66
Keosauqua	....	T	T	....	....	....	....	0.92	0.40	....	T	....	....	T	T	T	....	....	....	0.19	....	0.84	T	T	T	....	....	....	....	....	....	2.35
La Crosse, Wisconsin	....	0.03	....	....	....	....	....	0.32	0.02	0.08	0.26	....	T	0.08	....	....	....	....	0.03	0.20	....	0.50	0.17	0.11	T	....	....	....	....	....	....	1.80
Larrabee	....	....	....	....	....	....	....	1.07	T	....	T	T	0.15	0 05	....	0.10	....	....	....	....	0.30	..	0.50	0.30	....	....	....	....	....	....	....	2.47
Logan	....	....	....	....	....	....	0.12	....	....	0.10	....	....	....	....	....	....	....	....	....	....	....	....	0.52	0.10	....	....	....	....	....	....	....	0.84
Maquoketa	....	T	....	....	....	....	....	1.50	....	....	T	....	....	T	....	....	0.04	..	0.08	0.45	....	1.05	0.05	....	....	....	....	....	....	....	....	3.17
Marshalltown	....	....	....	....	....	....	....	1.10	....	0 10	....	....	....	....	....	....	0.07	....	0.20	....	0.05	....	0.45	....	....	....	....	....	....	....	....	1.97
Maxon	0.50	....	T	....	....	....	....	0.75	0.21	T	0.30	....	....	0 01	....	0.01	0.01	....	T	....	0.29	T	0.47	....	0.01	T	....	....	....	....	....	2.56
Mechanicsville	....	....	....	....	....	....	....	1 14	0.02	0.01	0.01	....	....	0.03	..	0.04	....	0.26	0.42	....	0.67	0.05	0.12	0.02	....	....	....	....	....	....	....	2.79
Monticello	....	....	....	....	....	....	....	0.95	0.01	....	0.05	....	0.06	....	....	....	0.02	0.10	....	0.42	0.20	0.48	0.15	0.70	....	....	....	....	....	....	....	3.14
Mt. Ayr	....	....	T	....	....	....	....	0.20	....	....	....	....	T	....	....	....	0.05	....	....	0.05	0.07	0 13	0.83	....	....	....	0.80	....	....	....	....	2.13
Murray	....	0.01	....	....	....	....	....	0.36	0.07	....	....	....	T	T	....	T	0.03	....	....	0.05	0.08	0.10	0.16	T	....	....	0.08	....	....	....	....	0.94
Newton	....	T	....	....	....	....	....	0.60	0.12	....	0.05	....	T	0.02	....	0.12	....	....	0.03	....	....	0.30	0.07	0.02	T	....	....	....	....	....	....	1.33
Omaha, Nebraska	....	....	0.06	....	....	....	T	0.20	0.01	....	0.01	....	0.01	0 01	....	0.19	0.04	....	....	....	0.02	0.05	0.20	0.04	....	....	0.38	....	....	....	....	1.29
Osage	....	T	....	....	....	....	....	0.45	0.41	0.08	....	....	....	0.25	....	....	....	....	T	0.27	....	0.48	0.36	0.12	0.04	....	....	....	....	....	....	2.46
Oskaloosa	....	0.04	....	....	....	....	....	1.03	....	T	....	....	....	....	....	0.14	....	....	....	0.30	....	0.36	....	0.03	T	....	....	....	....	....	....	1.90
Panama	....	....	....	....	....	....	....	....	0.42	....	....	....	....	....	....	....	0.06	....	....	....	....	....	0.00	0.02	....	....	....	....	....	....	....	....	1.10
Richland	....	0.04	....	....	....	....	....	1.59	....	....	T	....	....	T	....	....	1.02	....	....	0.42	....	....	0.94	T	....	0.02	....	....	....	....	....	....	3.03
Sioux City	....	....	T	....	....	....	....	0 70	0.03	....	T	....	0.01	T	....	0.13	0.02	....	T	....	0.05	0.16	0.30	0.03	T	....	....	....	....	....	....	1.43
Storm Lake	....	....	....	....	....	....	....	1.18	0.14	0.01	0.04	....	0.01	....	0.04	....	0.08	....	T	....	....	0.32	0.66	0.14	....	....	....	....	....	....	....	....	2.60
Tipton	....	0.04	....	....	....	....	....	1.30	....	....	0.02	....	....	0.02	....	0.04	....	0.10	....	0.64	....	1.19	0.35	0.05	0.02	....	....	....	....	....	....	3.77
Villisca	....	T	0.05	....	....	....	....	0.30	....	....	....	....	....	....	....	0.08	....	....	....	0.13	....	0.10	0.83	T	....	1.60	....	....	....	....	....	3.09
Vinton	....	T	....	....	....	....	....	1.13	....	0.08	T	....	T	T	....	0.05	....	0.10	....	0.24	T	0.35	T	T	T	....	....	....	....	....	....	1.95
Washington	....	0.08	....	....	....	....	....	....	1.64	....	....	....	....	....	....	....	0.12	....	....	0.24	....	0.55	0.07	....	....	....	....	....	....	....	....	....	2.70
Webster City	....	....	....	T	....	....	....	....	T	T	0.12	....	0.18	T	....	....	T	....	0.38	....	....	....	0.50	....	....	....	....	....	....	....	....	....	1.18
Williams	....	....	....	....	....	....	....	0.83	....	T	0.03	....	....	0.04	....	0.04	....	0.02	....	0.07	....	0.80	..	0.06	....	....	....	....	....	....	....	1 89
Winterset	....	....	T	....	....	....	....	0.48	....	....	....	....	T	....	....	T	0.05	T	....	0.15	T	0.51	0.66	T	....	....	T	....	....	....	....	1.85

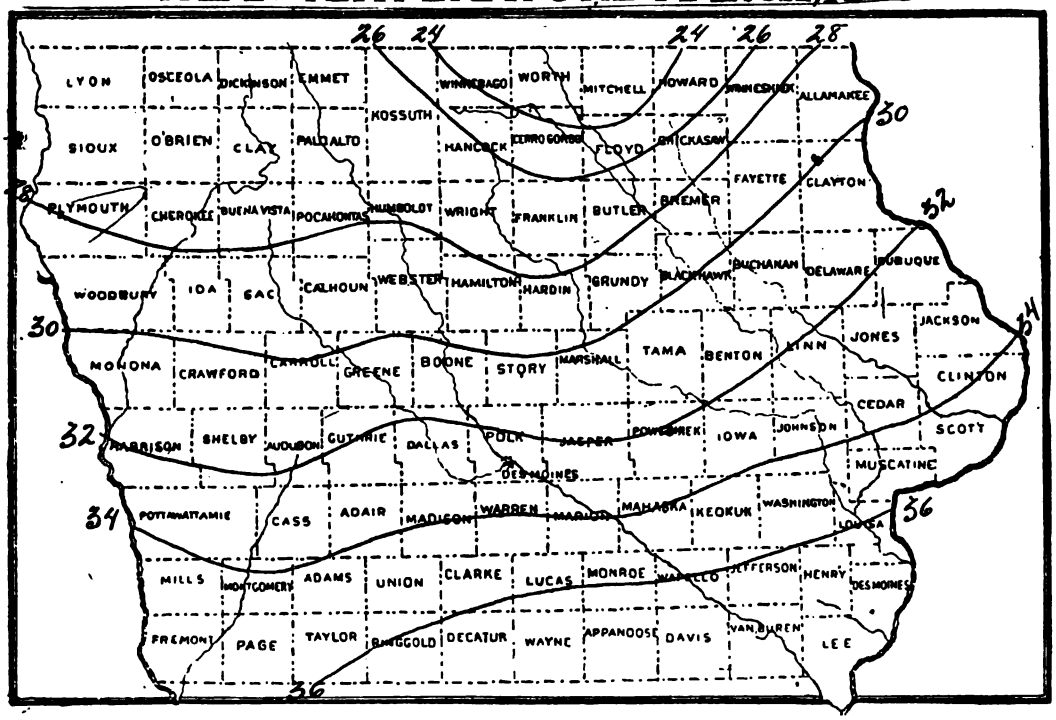
MAXIMUM AND MINIMUM TEMPERATURE FOR MARCH, 1893.

| STATIONS. | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | | 9 | | 10 | | 11 | | 12 | | 13 | | 14 | | 15 | | 16 | | 17 | | 18 | | 19 | | 20 | | 21 | | 22 | | 23 | | 24 | | 25 | | 26 | | 27 | | 28 | | 29 | | 30 | | 31 | | Monthly Mean. | |
|---|---|---

IOWA PRECIPITATION CHART MARCH, 1893.



MEAN TEMPERATURE MARCH, 1893



METEOROLOGICAL STATIONS AND OBSERVERS.

From the following, weekly and monthly reports of Meteorological data are received by the Iowa Weather and Crop Service.

Albia	Geo. Price.
Algona	C. D. Pettibone.
Alta	D. E. Hadden.
Amana	Conrad Schadt.
Ames	E. C. Dickinson.
Ames	E. N. Eaton
Ames. (4 miles S. W.)	Isaac Young.
Atlantic	J. W. Love.
Audubon	J. F. Hocker.
Belle Plaine	H. W. Vandike.
Blakeville	James Rodgers.
Blockton	C. W. Thompson.
Bonaparte	Hon. B. R. Vale.
Carroll	Moses Simon.
Cedar Falls	Prof. A. C. Page.
Cedar Rapids	H. D. Olds.
Centerville	J. I. Ong.
Charles City	J. W. Smith.
Clarinda	A. S. Van Sandt.
Clinton	Luke Roberts.
College Springs	A. A. Berry.
Concord	J. M. Elder.
Corning	John W. Bixby.
Corning	Jerome Smith.
Corydon	J. S. Whittaker.
Cresco	Gregory Marshall.
Davenport	*F. J. Walz.
Delaware	Wm. Ball.
Denison	P. H. Schlumberger.
Des Moines	Geo. M. Chappel, M. D.
Dubuque	*S. C. Emery.
Eagle Grove	C. A. Schaffter.
Eldora	Prof. C. F. Woodward.
Elkader	Chas. Reinecke.
Emmetsburg	H. Conroy.
Estherville	R. M. McKean
Fairfield	J. Fred Clarke, M. D.
Fayette	R. Z. Latimer.
Ft. Madison	Miss L. A. McCready.
Galva	Dr. D. W. Farnsworth.
Glenwood	Seth Dean.
Greenfield	J. G. Culver.
Grinnell	Prof. S. J. Buck.
Grundy Center	Chas. G. Rogers.
Hampton	E. C. Grenelle.
Havelock	P. H. Coquillette.
Hawkeye	J. W. Bopp.
Hopeville	M. T. Ashley.
Hopkinton	Theo. Marks
Independence	E. F. Wulfke.
Indianola	Prof. J. L. Tilton.
Iowa City	Prof. A. L. Arner.
Iowa Falls	J. B. Parmelee.
Jefferson	Dr. Chas. Enfield.
Keokuk	*Fred. Z. Gosewisch.
Keosauqua	Prof. J. H. Landes.
Larrabee	H. B. Strever.
La Crosse, Wis	*W. U. Simons.
Logan	Mrs. M. B. Stern.
Mason City	Edw. E. Wilcox.
Manson	W. L. Thompson.
Marshalltown	L. S. Kilborn.
Maquoketa	Dr. A. B. Bowen.
Mechanicsville	Rev. J. W. Hubbard.
McCausland	Miss Ruby Pearl Barr.
Milton	Hon. E. C. Holland.
Mooar	F. G. Thomas.
Monticello	Henry D. Smith.
Mount Vernon	Prof. A. Collin.
Murray	A. W. Lewis.
Muscatine	J. P. Walton.
Newton	A. Lufkin.
Omaha, Neb	S. S. Bassler.
Osage	G. D. Pattingill
Oskaloosa	Jos. Boyd.
Panama	Wm. J. Wicks.
Postville	F. L. Williams.
Richland	Wm. A. Shaffer.
Sanborn	T. D. White.
Seymour	Hon. L. W. Lewis.
Sibley	G. W. Baxter.
Sidney	G. V. Swearingen.
Sioux City	*U. G. Pursell.
Spirit Lake	R. B. Young.
Storm Lake	A. J. Bond.
Tipton	J. M. Rider.
Vinton	T. F. McCune.
Villisca	Hon. J. S. Boise
Washington	Wm. A. Cook.
Webster City	C. M. Trumbauer.
Winterset	Will McKnight.
West Bend	Phil. Dorweiler
Williams	M. L. Fuller.

*U. S. Weather Bureau.

WEATHER-CROP OBSERVERS.

Reporting for the Weekly Bulletin.

Afton	M. V. Ashby.
Agency	J. H. Van Zant.
Albia	Wm. Mercer.
Alta	Hon. H. T. Saberson.
Ames	Henry C. Wallace.
Anita	I. A. McKinley.
Ankeny	Ed. Parmenter.
Battle Creek	A. Preston.
Bloomfield	Geo. Duffield.
Boone	L. C. Morris.
Carbon	N. M. King.
Carson	G. N. Ferguson.
Centerville	Henry Galley.
Charles City	W. B. Towner.
Chariton	M. J. Burr.
Clarksville	F. M. Russell.
Clermont	Chas. Larrabee.
Council Bluffs	L. Prouty.
Dedham	J. W. Kay
Danville	Sherman Matthews.
Emerson	D. B. Nims.
Ely	Hon. A. J. Fuhrmeister.
Fontanelle	W. H. Bridgman.
Ford	W. W. Whitmore.
Fort Dodge	R. W. Blaine.
Geneva	Wm. H. Thompson.
Grand River	Dr. John Daykin.
Grinnell	A. O. Price.
Hesper	G. E. Dillingham.
Hodge	James Piper.
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Marshalltown	Hon. J. G. Brown.
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Mt. Pleasant	W. S. Wright.
Minburn	J. W. O'Brien.
Mount Vernon	Robert Smith.
Newton	J. P. Beatty
North English	J. L. Williams.
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Osage	E. W. Stacy.
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Polo Station	A. E. Miller.
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State Center	E. N. Thompson.
Sumner	John Dawson.
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Van Horn	Spencer Smith.
Wapello	O. P. Smith.
Waukee	John Wragg
Wheatland	D. Beckman.
Winterset	H. A. Kinsman.
Wyoming	R. A. Norton.
Wall Lake	T. E. Wilcox
Yankee	W. S. Nicholson.
Walnut	F. L. Martin.
What Cheer	O. D. Lawrence.

Met, 217.

UNITED STATES DEPARTMENT OF AGRICULTURE
WEATHER BUREAU.

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MONTHLY REVIEW

J. R. Sage,
Des Moines.

OF THE

Iowa Weather and Crop Service.

VOL. IV.—APRIL, 1893.—NO. 4.

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CENTRAL STATION, DES MOINES, IOWA.

J. R. SAGE,
DIRECTOR.

GEO. M. CHAPPEL, M. D.,
LOCAL FORECAST OFFICIAL,
U. S. WEATHER BUREAU, ASS'T DIRECTOR.

DES MOINES:
G. H. RAGSDALE, STATE PRINTER.
1893.

THE IOWA WEATHER AND CROP SERVICE

as established by act of the Twenty-Third General Assembly, and placed under supervision of the ard of Directors of the State Agricultural Society, constituted as follows:

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MONTHLY REVIEW

OF THE

IOWA WEATHER AND CROP SERVICE.

VOL. IV.] APRIL, 1893. [No. 4.

CORN AND OATS IN FARMERS' HANDS.

Circulars were recently addressed to correspondents of this bureau, asking them to give an estimate of the percentage of corn and oats remaining in the hands of the farmers May 1st. These reports received from every county in the State show the following averages: Corn, 18 per cent; oats, 16 per cent. We are satisfied this estimate is approximately correct. The winter and spring have been severe, calling for an unusual amount of food for all domestic animals, and the shipments have been considerable. And it should be remembered that in the dairy districts, comprising about one-fourth of the State, the farmers feed more corn than they raise, and have practically no corn of their own raising on hand.

WEATHER AND FARM NOTES.

Ice five feet in thickness was observed at Fargo, N. D., on the Red River of the North, on the first of April. At the close of the month the ice on the river at St. Vincent, Minnesota, was just breaking up. The vast extent of ice and snow at the north accounts for the prevalence of cold weather throughout the month.

***

Some genius could make his fortune by inventing an effective check-rein on the weather.

***

Visitors at the World's Fair during the opening week would have welcomed an exhibit of old-fashioned sunshine as about the best thing to be seen in Chicago.

***

The cold, wet weather in April was hard on spring chickens, as well as young swine. So there may be a shortage of broilers as well as squealers.

***

During the month of April there was rather more than the usual amount of tornado activity in various parts of the country, and Iowa suffered less damage than some of the southern and western States. The southward trend of the low areas was a marked feature of the month.

***

Dr. Joel W. Smith, of Charles City, Iowa, writing to the *American Agriculturist* on the good roads question, says:

"The good roads agitation is a hopeful sign. With it should be considered the question of distance. A county is usually from twenty to thirty miles square. In most of the States, roads are under county authority. In hilly regions the roads must conform to the natural surface of hills and streams. In nearly level or prairie sections, roads usually follow the right angled survey of the land. Before expending the amount of money necessary to secure good roads, it will be best to duly consider the subject of location and distance in the case of all the main roads. The location can often be greatly improved as to distance, ease of grade, first cost of road and keeping in repair. Square fields are preferred by farmers, other things being equal, but distance, amount of land and the kind of road to and from market, may often be of greater importance to farmers and the public. There is a great difference in distance between right angled and diagonal roads. A right angled road eight miles on one side and six on the other is fourteen miles, but only ten miles diagonally between the two points; or a saving in that case of four miles, nearly one-third, in distance, in travel, cost of land, of road, of construction and keeping in repair over those at right angles. Considering the great necessary cost of roads that will be permanently good at all seasons, will not the saving by diagonal roads often be much greater to the public than the loss to farmers by a few main diagonal roads? The taxpayers can well afford to pay all individual damage to farmers. Then the saving in amount of land by diagonal roads will sometimes equal the real damage to individuals, and, where it does not, the public can far better pay the damages than to construct, keep in repair, and travel the longer distance around square fields and farms. Many

farms would double in value by better roads and less distance to good towns. If the farmers are to have the best roads they should begin right."

***

The successful weather forecasts in the British Isles have averaged 81 per cent since 1882. Last year the average was 80, the lowest percentage being 75 for the west of Scotland, and the highest, 84, for the south of England. The average rainfall for twenty-seven years has been 34.9 inches. The wettest district is the west of Scotland, where the average rainfall is 45.5 inches and the driest is the east of England, where the average amount is 25.8 inches. For the wheat producing districts the average fall is 28.2 inches, and for the grazing and other districts, it is 41.6 inches. The average temperature for twenty-seven years has been 48.4°. Last year was 1.6° colder than the coldest since 1879.

***

Prof. James Wilson says: "The agricultural four years, course at Ames has thirty freshmen, twenty-three sophomores, six juniors and four seniors. The spring dairy course has fifteen. This is the result of two years' work. The young farmer is concluding that educated men in his line have better prospects than any other class in the west. The demand for men trained to teach scientific and practical agriculture, to write for papers concerning the farm in all its departments, to manage landed properties intelligently, conduct creameries economically, and do other things so many people want well done that so few are studying to do at all, is an imperative demand and grows every day. Congress endowed the agricultural colleges to educate the farmer and mechanic just as it endowed universities in many States to train the professional. □ In most States the universities absorb the endowments without educating farmer or mechanic in their callings. Our college has taken a new departure, and the future will see some good results."

***

Secretary Morton has shown excellent judgment in designating Major Dunwoody to act in the place of Major Rockwood as Assistant Chief of the Weather Bureau. Major Dunwoody is one of the few officers who, during all the years of his connection with the Bureau, has retained the esteem and confidence of its employes, and not so much by the exercise of any graces of manner as because of his rugged honesty and his well known devotion to the interests of the service. He has been an earnest student of the means of extending the usefulness of the Bureau to the public through the medium of better forecasts, as well as through the agency of State weather services, which, under his care, have greatly extended in the past few years. As a forecaster of the weather his record is without parallel. Thoroughly informed, both as to the work and *personnel* of the service, conscientious and conservative Secretary Morton could not possibly have made a better selection.—*Rank and File.*

PROPHET HICKS' APRIL FORECASTS.

There are many people who pin their faith on the long range weather prophecies of the Rev. Irl R. Hicks, of St. Louis, and they consult his "Word and Works," as credulously as old time people used to con the weather tables of their almanacs. A local paper of Des Moines published Prophet Hicks' April forecast and referred to him as one who has proved himself a prophet indeed by the accuracy of his predictions.

To show how random and wild have been his guesses, and how unworthy of the popular favor with which they are generally accepted by the community at large, I have attempted to compare the actual weather conditions during the month, as shown by the reports from weather bureau stations, with Prof. Hicks' "disturbances," as he unveils them to mortal gaze in "April Weather."

"We name the 3d, 4th and 5th as danger centers," says Prof. Hicks, and he especially emphasizes the statement by further informing us that this particular "disturbance" will feel the combined influence of Mars, Venus and all the other heavenly influences that can be induced to enter upon this cyclonic devastation of mother earth. What were the actual conditions of weather during this time?

From April 1st to the 10th there were no severe thunder storms, no hail storms, nor were there any tornadoes reported within the confines of the United States; and the precipitation was far below the normal, with the exception of a narrow strip in the extreme northwest, and another in the vicinity of the lower lake region. True, it was very warm (especially in the south and southeast.) But "very warm" for *that* section is not an unusual condition for any April. The westerly part where, according to Prof. Hicks, the weather should have been very warm was, to say the least, rather cool, the mean temperature being from two to six degrees below the normal.

Referring again to Prof. Hicks' prophecy: "Between the 13th and 18th the whole country will feel the effects of a very warm wave." The reports received from Weather Bureau stations, scarcely adds to the luster of his reputation. The temperature fell to zero in Minnosota on the 15th and for the week ending April 17th the National Weather Crop Bulletin, shows a mean temperature of from one to nine degrees below the seasonal normal, over the entire United States, with the exception of a narrow strip of territory along the South Atlantic coast, and another in the vicinity of the lower lakes.

On the 18th a storm area (*i. e.* an area of low barometric pressure) was forming over Kansas, which moved very slowly northeast, and with increasing intensity until the morning of the 20th when Davenport reported a barometric reading of 28.8 inches, the lowest pressure ever reported from Iowa. This storm gave heavy rains and snows to the central and eastern portions of the country. Severe wind storms were also characteristic of this disturbance in several localities. The rainfall, however, still remained below the normal at the end of this period.

"The 25th is the central day of the last period," continues Prof. Hicks, "and it will grow very warm again, and many heavy storms of rain, hail and thunder will travel from west to east across our continent."

What are the actual weather conditions? Referring to the National Crop Bulletin I quote as follows. "The week ending April 24 has been unusually cold. Throughout the central valleys, including the greater portion of the cotton region and all of the winter wheat region, the temperature ranged from 6 to 12 degrees below the seasonal normal." Comment upon Prof. Hicks "temperature" for this period after comparing the actual weather conditions with his prediction would seem superfluous.

True, there were several severe wind storms during this latter period and extensive rains prevailed over the central valley region. But extensive rains are characteristic of April weather in general, not simply the weather of 1893.

Referring again to a statement contained in Prof. Hicks' Weather for April, "about this time many severe storms of thunder and lightning will sweep across our continent from west to east." Now such a statement is not only entirely erroneous, but it tends to mislead the general public. Meteorology, while perhaps not as exact a science as some, yet has certain well defined laws. Thunder storms do not sweep across our continent from west to east, as do the well marked cyclonic disturbances, mentioned in this paper as storm areas, and it would be well for Prof. Hicks to realize this truth. What I desire to protest against is the sweeping generalities contained in his statements and the sensational desire of alarming people needlessly in order that he may find a readier sale for his publications.

His assertions are like a gattling gun filled with large and small shot; what the small size does not catch the larger ones will. If it does not rain on the 1st the 10th will answer just as well. A tornado is billed for the northwest, Texas gets it, and the prediction is fulfilled. Take again the following statement: The Venus characteristics, hail, startling electrical phenomena, enormous down-pours of rain and sudden changes from heat to cold. I would ask Prof. Hicks in all candor if such phenomena are not characteristic of general April weather in the intermediate latitudes, and if it does not seem to be especially true of every spring immediately following a severe winter?

Reactionary storms of considerable violence must necessarily follow the gradual warming up of the earth, while the country to the north of us is still covered with and ice.

And if we will take the record of Iowa for the past fifteen years, the actual weather conditions bear out the assertion that April is a month of severe wind storms, and he who predicts storms of rain, hail, sleet and startling electrical phenomena, promiscously throughout the month, deserves no special credit therefor.

JOHN S. HAZEN,
Asst. Observer U. S. Weather Bureau.
DES MOINES, IOWA.

TORNADOES--WHAT THEY ARE AND WHERE AND WHEN THEY OCCUR.

[By Prof. Mark W. Harrington, Chief of the Weather Bureau.]

Probably the most intense action of the forces of the air are to be seen in the tornado. The word "tornado" is from the Spanish, and means twisted. Tornadoes proper are essentially "twisters"—small whirls of great intensity; but along with the twisting occur several curious features, in part easily seen to be the result of this twisting, in part not easy to explain. For instance, tornadoes are apt to carry much mud and dirt with them, and this they drive with such force into timber and clothing that it is about impossible to get it out again. When a tornado crosses a north and south fence and leaves it standing, toward the south end the mud is plastered on the west side, and toward the north on the east side. This is because the tornado is a whirl and the direction of motion is contrary that of the sun. The tornado often strips the clothing entirely off its human victims. If its victims are fowls, the feathers are often stripped off completely.

Tornadoes sometimes exercise a curious expansive action. If the walls of a house are not carried away, and especially if the whirl passes centrally over it, they are likely to fall—not inwards or toward one side, but outward in all directions.

At other times the effect is more like that of suction. Boxes are opened and their contents tossed out. Files of papers are neatly uncovered and the papers promptly distributed over the country, but especially toward the northeast.

What are called tornadoes seem to be at least five different sorts of phenomena, but with no sharp line of distinction between them.

The first is a slight phenomenon, really a dust column; but, occurring at a place where dust columns are not familiar, it is called by another name. Such was probably the character of the "tornado" photographed at Garnett, Kansas, in 1884. They are much like some waterspouts.

The second is the real tornado or "twister." It is characterized by a funnel hanging down from the clouds. It has been photographed several times and sketched many times, but the pictures of it are by no means reliable. The conditions under which the photographs and pictures are made are not favorable for good work; besides, the temptation to exaggerate and to piece out imperfect pictures seems to have proved irresistible. These are the true tornadoes, and most of the facts given here relate to them.

The third form appears rather as horizontal than as vertical whirls.

They appear to be what Dr. Hinrichs has called derechoes (from derecho, straight), and advance in the form of a horizontal roll of dust. The front extends in length as they advance, so that the territory they pass over is fan-shaped, instead of the strap-shaped area of the tornado proper. This form may do some damage by overturning trees or breaking off their limbs, and by unroofing barns, scattering flocks, distributing haycocks or wheat shocks

over the neigboring country, but they are not nearly so destructive as the second form.

The derechoes pass by insensible gradations into thunder-storms, and severe types of these are sometimes called tornadoes or "cyclones."

The fifth form is what may be called a wind-rush—that is, a little narrow gale. Sometimes several wind-rushes travel parallel to each other at a distance of a few furlongs apart. This seems to have been the true character of the violent wind-storm that crossed the city of Washington on November 23, 1891, and demolished an unfinished building, killing one man.

The tornado occurs at the hottest time of the day and in the hottest season of the year.

They are especially likely to occur when the temperature is unseasonably warm and the air very moist. They are most usual when the air is calm, "close," murky; still, hot afternoons are the most favorable for them.

They occur in all temperate latitudes where the air is not too dry. England, France, Germany and China have their tornadoes. There is also a tropical storm called tornado common on the coast of equatorial West Africa. The United States has the reputation of producing the most destructive tornadoes; and also of having the greatest number.

Tornadoes travel in a northwestward direction and leave a path a few rods wide by a few miles long.

The danger is greater on the south side of a tornado than on the north side, because there the speed of advance (twenty to forty miles an hour) is added to the speed of the whirl in the tornado.

When a tornado actually comes, which, though not probable, is always possible, the proper thing to do is to run northward, if there is time, and it will pass to the south; run south or southeast if it passes well to the north; take to the cellar if it is not certain where it will go.

The cellar is the safest place in all cases and its west wall or southwest corner is the safest part of it.

Tornadoes generally occur to the south of a general storm, generally rather east of south—rarely west. The winds flow into a "low"—that is an area of low barometer—in a spiral direction, but sometimes a "low" takes on an elongated form or has an extension southward. In this case the cold inflowing winds from the northwest are likely to meet the warm and moist winds in an area extending southward or southeastward from the center of the "low." This area is sometimes narrow and the line advances, like a rank of soldiers, across the country from the west to east, with hot, close, moist air in front, and cold, fresh, drier air behind.

It is along such a line that thunder-storms, derechoes, wind-rushes and tornadoes are most likely to happen. This may be called the "critical line" of the "low." In some it is well marked and its passage unmistakable; in others it can be located on the weather map, but would not be noticed by people generally; in still others—and they are the most numerous—no trace of a critical line can be detected.

We do not know that electricity makes them, though they often but not (always) show remarkable electric phenomena.

We do not know that tornadoes are increasing in number, but we do know that the area in which they occur is becoming more thickly settled and that the art of reporting news is constantly growing in efficiency and completeness.

There is one thing we do know about tornadoes and that is that the danger to any one person meeting death or injury from them is extremely small. That of meeting death by lightning, small as it is, is twenty times as great. That of meeting death by railway travel is much greater yet, and that from driving a horse and carriage is still greater.

THE NEEDS OF METEOROLOGY.

Within the past thirty years all branches of science have made remarkable progress, and some have become so prominent as to seem like wholly new creations; this is notably the case with electricity and meteorology. The study of electricity is not only opening up to us a deeper insight into the ultimate properties of the molecules of matter, but is accompanied by such important and varied applications to the arts of civilization that we are rapidly passing from the "Age of Steel" to the "Age of Electricity." Such progress has evidently only become possible through the fact that the physical laboratories of the world have turned our attention so largely to the purely scientific investigation of electrical laws. We must first know the laws of nature before we can apply them to human needs. The scientist must discover before the inventor can apply.

Both governments and private individuals have, these many years, vied with each other in stimulating physical, chemical, and astronomical science. These have been encouraged in the great universities where laboratories and observatories have been equipped with the finest apparatus and provided with the most learned mathematicians and the most skillful experimenters. Thousands of students have been attracted by these studies, and it is now well recognized, in these departments, that great advance is only likely to be made by those men who, to inherited gifts, have added great advantages of study and training. So well is this understood that it has even become customary for the wealthy to erect to themselves monumental observatories and laboratories, university chairs and prize funds, devoted to the furtherance of physics and astronomy.

But there is one subject of importance to mankind that has, it seems to me, as yet received only partial and imperfect recognition. Although meteorology has always been recognized as of the highest utility, yet it is not studied in our universities and scientific schools on a scale commensurate with its practical importance. As soon as it was feasible to make daily weather maps, from daily telegraphic reports, the governments of the world established their weather bureaus on a scale proportion-

ate to the material interests involved, and now for nearly forty years the art of predicting the weather has gradually been improved upon; this work is done by empirical methods quite analogus to those which the ancients employed in the predictions of solar eclipses.

What meteorology needs is that its methods should be perfected by experimental work similar to that done in the physicial laboratories, and by mathematical work similar to that done in astronomical institutions. It is high time that we began to pass from the empiric to the philosophic methods, but I see no prospect of doing this unless our universities give the young men who are in special training for the pursuit of the exact sciences, full opportunity to acquaint themselves with the beauty and the importance, the difficulties and the possibilities of the problems of meteorology.

There are in this country a dozen institutions of learning which offer young men the highest education in mathematics, chemistry, physics, and astronomy; why not also in meteorology? Each of these has from fifty thousand to five hundred thousand dollars invested in astronomical apparatus, with only here and there one or two special students in this science. Equal amounts are invested in chemical and physical laboratories; many students take these courses and an appreciative knowledge of these subjects begins to pervade the community; but, of course, only very few of these students take up these studies as their life-long profession.

To any one who desires to increase the attractiveness of his university, or to be a benefactor to science, or to establish a monument honorable to himself, or to invest a large sum of money in a manner that will never be regretted, I would say do for meteorology and terrestial magnetism that which has so often been done by others for other sciences. Give your name and your fortune to a meteorological laboratory in connection with some one of our best endowed universities; call around you a few able investigators with every appliance for increasing our knowledge in this branch of science; let the young men of our country understand that after proper, thorough preparation, they may at your institution perfect themselves in this study.

Our government and State weather bureaus are established for *doing work* and not for giving instruction; they will need to employ the students whom you graduate from your school of meteorology. Just as the learned astronomers of our universities and observatories have built up a recognized science of astronomy which the practical navigator and surveyor brings into daily use in his work, so will learned professors in such schools of meteorology constitute a body of leaders in scientific thought, to whom the youth of the country will inevitably resort for instruction.

Who will be the first to establish an American school of meteorology?

I know of no more inviting field than this for the investment of funds that are to be devoted to the intellectual progress of our beloved country. That I am not alone in my opinion is evident from the fact that on mentioning my convictions to a friend, eminent in both educational and practical matters, he replies: "There is certainly very great need for such a department, not only for its own sake, but for the sake of kindred departments. We feel it very much in geology, and have been discussing the propriety of introducing temporarily, as a part of our department, courses on the salient features of meteorology. We feel that we can not develop the 'new geology' satisfactorily without it. We would welcome the establishment of an independent fully developed meteorological department, such as you outline, and I hope we shall be able to secure it at an early date." So deeply does the importance of the subject commend itself to my judgment that if anyone desires to have a more detailed plan of work, I should be glad to assist in elaborating it. If a further assurance of unselfish interest in the matter is desired, I may add that I have a scientific library of five thousand or six thousand books and pamphlets that I should be pleased to donate to a well-endowed meteorological institute connected with either Harvard or Yale, Columbia or Johns Hopkins, Michigan or Chicago, or other university of similar rank where the auxiliary physical and mathematical sciences are properly taught. —*Prof. Cleveland Abbe, in American Meteorological Journal.*

A DROUTH IN EUROPE.

Europe has had an almost unprecedented drouth on hand for some time. A dispatch from London says that it has been two full months since rain has fallen in Paris or London, save a little shower one afternoon, which yielded a quarter of an inch of water in some parts of the latter city. England has no recorded parallel of long drouth. France has to go back more than a century and a half, to 1733, to find an equal period of dryness. Rain has become such a phenomenon that people quite enjoy reading statistics about it, and in Paris telegrams announcing showers in distant provinces are posted, and scanned with as much interest as news of earthquakes would be. There is already a very serious side of the subject. There is a genuine famine of green vegetables, and prices are fifty to a hundred per cent above the normal. Great forest fires, which in some cases have destroyed villages, have swept large tracts in various parts of Europe this week. Even grass has withered and there is not the usual spring pasturage for the stock. March and April have, in temperature, been like May and June, so that the spring planting was all done some weeks earlier than usual. The seed either has not sproted or has sprung up so feebly that there is small prospect of fruition. The drouth is also becoming ominous from a sanitary point of view, in many places. There is no sign of change. The sun still shines through the usual London haze, and the shady side of the Paris boulevards is most crowded.

Coming so close upon the heels of a famine in Russia this drouth and its consequent disastrous effect upon the food products of Europe must be felt heavily abroad. Europe has been in the throes of a trade depression for a year or more and this fresh misfortune must have a very

bad effect upon the trade. America, we are glad to know, will be able to do much to relieve the distresses of her old world fellowmen and give her own young men fresh cause to be proud of the land of their nativity where plenty is the rule and distress and squalor the exception.—*Ohio Valley Manufacturer.*

DIFFERENCES IN RAIN GAUGES.

CONCORD, IOWA, April 26, 1893.

HON. J. R. SAGE, *Director:*

Your remarks on those of the *Farmers' Institute*, under the caption of "Rainfall and Dairying," naturally direct attention to the cause of the difference between old and new records of rainfall. The average rainfall at this place for the twelve years ending December 31, 1891, was 24.36 inches, and that for 1892, 27 14 inches. During the entire first named period rain collections were made entirely in the Hinrichs' cylinder gauge, while those for the past year were recorded from measurements in the Signal Service gauge, now generally used, but at the same time comparisons with the former were made.

I am satisfied the collections by the Hinrichs collector will fall ten per cent below the Signal Service instrument. This difference may be caused in part by the different systems, but I believe more through evaporation in the open gauge than any other.

The disparity found in the article in question could easily arise from the cause above stated.

Yours truly,

J. M. ELDER.

DAVENPORT WEATHER DATA.

LATE AND EARLY SNOWS. LATE FROSTS AND APRIL WINDS.

From the *Davenport Democrat:* At the request of the *Democrat*, Observer Walz has searched the records of his office for the dates on which the last traces of snow have been seen ere winter made way for spring, in the twenty years or so that records have been kept. He has also tabulated the dates upon which the first snow had fallen in the fall of the year, and the information is given herewith:

LAST.	FIRST.
1871—April 15	Nov. 15
1872—April 15 (t)	Nov. 15
1873—April 24 (m)	Oct. 22
1874—April 27	Oct. 30
1875—April 16 (lt)	Oct. 26
1876—March 28	Nov. 6
1877—April 29 (lt)	Nov. 1
1878—March 30	Oct. 26
1879—April 2	Nov. 1
1880—April 18	Oct. 16
1881—April 12	Nov. 11
1882—May 23	Nov. 25
1883—April 6	Oct. 24
1884—April 8	Nov. 4
1885—April 12	Oct. 20
1886—April 1	Nov. 17
1887—April 24 (t)	Oct. 22
1888—April 3	Nov. 15
1889—March 29	Nov. 26
1890—March 29	Dec. 2
1891—April 6	Nov. 12
892—April 13 (m)	Nov. 7

The letter "t" accompanying some of the dates indicates that only a trace of snow fell, not enough to be measured; 'm" means that the snow melted as it fell; "lt" means light. The snow storm on the 27th of April, 1874, was quite heavy, although the snow did not stay on the ground long. Last year's fall of snow on the 13th was also quite heavy although the snow melted about as fast as it fell. The record breaker, however, was 1882, when on May 23, from 2 to 5:40 P. M., snow fell continuously and heavily, the storm being well remembered by many people here. The temperature was 34 degrees, however, and no preceptible amount remained on the ground long after the fall ceased. This is the record as far as it goes, although the oldest inhabitant is not barred from remembering a snow storm in June or later.

The following table, showing the dates on which the last killing frosts have been recorded for the past twenty years, will be of general interest. The dates are:

1874	April 28	1884	April 22
1875	May 6	1885	May 9
1876	May 1	1886	April 8
1877	April 30	1887	April 26
1878	March 28	1888	May 13
1879	April 11	1889	April 6
1880	April 1	1890	May 6
1881	April 14	1891	May 5
1882	May 22	1892	April 15
1883	May 22		

It will be noticed that the spring of 1880 shows the greatest equability of temperature, while 1882 and 1883 show the latest freezes.

April, 1892, was the windiest month ever recorded here. The total wind movement was 11,205, whereas an average record is about 7,000 miles. This month promises well to exceed even this big record. Up to midnight Wednesday night the total movement recorded for the month was 9,916 miles, with four more days left to hear from. The last twenty-four hours included in the above record increased it by 581 miles, and with quite a decrease in the wind the 322 miles a day necessary to break the record will doubtless be recorded ere the month closes.

JUNE WEATHER.

The following data, compiled from the record of observations at the Des Moines station for the month of June, during a period of fourteen years, will prove of interest to the public; showing as they do the average and extreme conditions of the meteorological elements, and the range within which the variations may be expected to keep during any corresponding month.

TEMPERATURE: Mean or normal temperature, 65°. The warmest June was that of 1890, with an average of 73°; the coldest June was that of 1889, with an average of 67°. The highest temperature during any June was 101° on June 14, 1886; the lowest temperature during any June was 37° on June 1, 1889. Average date on which last "killing" frost occurred (in spring), May 17.

PRECIPITATION (rain and melted snow): Average for the month, 5.68 inches; average number of days with .01 of an inch or more, 11. The greatest monthly precipitation was 15.79 inches in 1881; the least monthly precipitation was 1.21 inches in 1886. The greatest amount of

precipitation recorded in any 24 consecutive hours was 4.80 inches on June 5, 1879.

CLOUDS AND WEATHER: Average number of cloudless days, 8; average number of partly cloudy days, 14; average number of cloudy days, 8.

WIND: The prevailing winds have been from the S. The highest velocity of the wind during any June was 45 miles SW on June 5, 1890.

GEO. M. CHAPPEL, M. D.
Local Forecast Official, U. S. Weather Bureau.

APRIL WEATHER REPORT.

April, 1894, was abnormally cold, wet and cloudy. The first decade was warm, dry and unusually favorable for farm work; the second was cold, wet and backward, and the third was the coldest period of the month. The mean temperature of the State, 45.5°, was about 4° below the normal. The percentage of cloudiness was nearly double the normal amount. The average precipitation, 4.21 inches, was 1.50 inches above the seasonal average. Snow squalls and frosts were of frequent occurrence in the last half of the month. The distribution of moisture is shown by the precipitation chart. Some account of the more severe and destructive storms of the month are given under a separate heading.

The following table gives, as a basis of comparison, the mean temperature and total precipitation for the month of April, at the stations named, in the years from 1872 to 1893, inclusive:

YEARS.	MEAN TEMPERATURE, DEGREES.						PRECIPITATION, INCHES.					
	Des Moines.	Davenport.	Dubuque.	Keokuk.	Omaha.	Sioux City.	Des Moines.	Davenport.	Dubuque.	Keokuk.	Omaha.	Sioux City.
1872	....	50	....	53.7	51	....	.....	5.06	.....	3.86	3.84	.....
1873	...	47	...	47.8	45	....	.....	3.96	.....	5.65	3.83	.....
1874	...	41	41	43.6	45	....	.....	2.64	1.54	2.40	2.03	.....
1875	....	46	45	48.7	45	....	.....	2.30	2.71	0.89	3.06	.....
1876	....	51	49	52 3	51	....	.....	5.39	3.63	3.99	2.65	.....
1877	....	49	48	51.2	50	....	.....	3.28	3.74	4.22	6.24	.....
1878	....	55	54	56.8	55	....	.....	2.89	4.34	2.31	3.97	.....
1879	51	50	51	51.9	54	....	1.03	1.54	2.02	1.56	1.77	.....
1880	50	50	48	54.6	51	...	1.56	4.50	3.51	4.79	0.55	.....
1881	43	45	44	46.8	44	....	3.36	1.11	1.30	3.12	4.23	.....
1882	51	51	48	54.1	52	....	3.47	3.15	4 47	3.22	4.31	.....
1883	52	52	50	53.8	54	....	3.48	3.33	1.93	2.97	3.20	.....
1884	49	50	48	50.9	48	....	3.97	0.77	2.77	1.31	3.88	.....
1885	49	49	47	50.3	50	....	3.62	2.47	3.69	3.33	7.34	.....
1886	53	52	51	54.3	51	....	4.32	1.84	2.12	1.52	1.77	.....
1887	52	52	51	54.1	54	....	2.48	1.17	1.37	1.84	0.88	.....
1888	51	50	48	53.6	52	...	1.45	1.57	2.58	1.85	2.95	.....
1889	50	50	49	53.9	52	....	2.66	3 89	3.56	3.60	1.19	.....
1890	53	53	51	54.7	55	52.1	0.78	0.86	2.94	1.79	1.55	1.32
1891	52	52	51	54.0	54	52.6	2.12	3.30	1.63	5.06	2.80	2.22
1892	47	47	46	49.1	48	46.5	3.36	5.41	4.37	6.15	4.82	4.76
1893	46	47	45	49.9	48	44.6	5.61	4.50	4.32	5.41	3.12	3.56
Means	50	49	48	52 1	51	49.0	2.82	2.72	2.85	2.84	3.15	2.96

SUMMARY OF WEATHER CONDITIONS.

BAROMETER: Mean temperature for the month, 29.89 inches. Highest observed, 30.32 at Cresco, Sioux City and Omaha, Neb., on the 11th; lowest observed, 28.80 at Davenport on the 20th. Range for the State, 1.52 inches.

TEMPERATURE: Monthly mean, 45.5, determined from 73 reports of observers. Highest monthly, 524, at Ft. Madison; lowest monthly mean, 38.6, at Osage. The highest temperature reported was 96 on the 6th, at Glenwood; the lowest temperature reported was 15, at Eagle Grove and Ft. Madison on the 9th. Average daily maximum, 80.7; average daily minimum, 22.2. Average monthly maximum, 56.2; average monthly minimum, 35.0. Greatest monthly local range 74, at Ft. Madison; least local monthly range 44, at Sac City. Average monthly range, 58.3; range for the entire State, 81.

PRECIPITATION: Average for the State, 4.21 inches. The greatest amount reported, 8.51, at Fairfield; the least amount reported, 1.24, at Villisca. Average number of days on which .01 inches or more fell, 10.1.

MISCELLANEOUS DATA: Average number of cloudy days, 13.4; part cloudy, 8.7; clear, 7.7.

HALOS: Amana, 23d; Hopeville, 9th, 10th, 15th, 24th.

THUNDERSTORMS occurred quite generally through the State on the 3d, 11th, 26th and 28th.

HIGH WINDS: Audubon, 7th; Alta, 11th, 19th, 26th; Centerville, 2d; Greenfield, 7th, 8th; Murray 7th.

HAIL: Audubon, 11th; Blakeville, 6th; Centerville, 3d, 11th,; Des Moines, 11th; Indianola, 26th; Panama, 11th, 26th.

SLEET: Independence, 28th.

PARHELIAS at Ames the 23d; Independence, 7th.

DUST STORM at Glenwood the 7th.

ATMOSPHERIC PRESSURE.

STATIONS.	Mean actual barometer.	Mean reduced barometer.	EXTREMES. Highest barometer	Date.	Lowest barometer	Date.
Cresco	.....	.....	30.32	9	29.24	20
Clarinda	.....	29.89	30.31	9	29.33	20
Davenport	.....	29.87	30.25	17	28.80	20
Des Moines	28.94	29.89	30.28	9	29.22	11
Dubuque	.....	29.89	30.28	17	28.95	20
Keokuk	29.22	29.88	30.28	9	28.93	20
Omaha, Neb	.....	29.91	30.32	14	29.11	11
Sioux City	.....	29.89	30.32	14	29.01	11"
Means	29.08	29.89	30.32	14.9	28.80	20

WIND MOVEMENT.

STATIONS.	Miles.	Maximum velocity.	Direction.	Date.
Davenport	11,567	50	SW	12
Des Moines	8,769	41	SE	25
Dubuque	6,726	36	SW	12
Keokuk	7,375	38	NW	20
La Crosse, Wis	7,245	33	NE	20
Omaha, Neb	8,411	48	NW	20
Sioux City	11,790	54	NW	20"

OBSERVERS' NOTES.

Clinton—DR. LUKE ROBERTS. April, 1891, was of seasonable warmth and fairness for the first fourteen days, and furnished favorable conditions for seeding and preparation of the soil for planting, and the farmers utilized every day to the best advantage. The remainder of

the month was almost wholly cloudy with frequent showers and chilly temperature.

Field work was greatly retarded and vegetable growth almost at a stand. Fruit trees were belated, grass of slow growth and horticultural pursuits embarrassed. The hindrances to cultivating the soil and to the growth of vegetation was not so much due to the amount of precipitation as to its constant drizzle, lack of sunshine and low temperature.

The last day of the month was colder than the first. By decades the mean daily temperature was as follows:

First decade, 53.3°; second decade, 45.3°; third decade, 41.4°. The highest temperature for the month was 87°—4.1° above normal. Minimum temperature was 24°—2.8° above normal. The mean temperature for the month was 46.7°—4.6° below normal, and the same as in 1892. The warmest day was the 7th, mean temperature 68.3°—2.6° above normal. The coldest day was the 21st, mean temperature, 35.5°. Notwithstanding the maximum and minimum temperature the temperature of the warmest and coldest day was above normal, the mean for the month was far below.

During the last fifteen years there were but two Aprils colder, viz: 1879, 1° colder; 1881, 4° colder. The per cent of cloudiness was 61. This was exceeded in April, 1884, by 3 per cent, and in 1885 by 4 per cent.

The principal storms were on the 11th and 20th. The former was accompanied with thunder and lightning and the latter turned to snow at 5 P. M., and continued lightly for two days. Total precipitation 5 48 inches, 2.27 inches above normal. But one other April in the last 15 years that furnished greater, viz: 1882, the rainfall was seven inches. The number of storm days was 13—5 above normal. The number of cloudy days 8—1 below normal.

The movement of wind was greater than in March and in excess of an April normal by 655 miles. The total movement was 6,760 miles, and the maximum velocity 32 miles an hour. But one April in the last 12 years furnished a greater number of miles movement of wind, viz: 1883—7,380 miles, with a maximum velocity of 40 miles an hour. The prevailing direction of the wind was equally divided between the west, northwest and east. The storms were largely from an easterly direction.

Hopkinton—THEODORE MARKS: The maximum temperature during April was 78° on the 3d; minimum, 28° on the 23d. Mean of the month, 47°. During first decade the mean temperature was 55°; second decade, 45°; third decade, 41°. Precipitation of the month, 3.60 inches. Snow fell to depth of 3 inches. There were 16 cloudy days—13 during the last half. The month of April was wrong end foremost.

Alta—DAVID E. HADDEN—*High Winds*—April 11 and 12, 1893. From early of 11th wind southeast, high to about 6:00 P. M. when it changed to northwest and continued all day of 12th to forenoon of 13th. Very dark on 11th from 4:45 to 5:50 P. M., with light rain, heavy gusts of wind and sudden rise of 5° in temperature.

Storm—19th-21st. Heavy rain 19th, wind changed sudden to northwest on 19th about 12:00 M., with ud den fall in temperature, followed by snow in afternoon and northwest gales. A furious blizzard set in and continued all day of 20th, with increasing northwest gales. One of the worst storms of the season; snow drifted several feet deep in streets, and 8 to 10 feet in country. 25th-26th. Rain, followed by snow storm and high winds from northwest. Very dark and smoky atmosphere on 7th from 3 P. M. to sundown.

Bonaparte—HON. B. R. VALE: The first half of the month was favorable for agriculture, but the last half has brought farm work and the growth of vegetation to a stand still.

College Springs—A. A. BERRY: First part of month warm and dry; last half cold and wet, retarding farm work and the growth of vegetation. Pig crop will be as short as last year, or less, owing to various causes. Fall wheat looking better, and will be about an average crop, but about 20 per cent less than last year.

SEVERE LOCAL STORMS.

The month of April was characterized by severe and destructive storms in all parts of the country, and Iowa received a small but sufficient share of these unwelcome visitations. The first notable storm period began on the 11th, on which date a "low," or cyclonic disturbance of great proportions and unusual activity, passed across the upper Mississippi valley, the track of its center crossing near the the northwest corner of the State, in a northeasterly course. It was accompanied by heavy rains and dangerous winds, and the local forecast for Iowa—severe local storms—was fully verified. The bulk of the State was in the southeast quadrant, the dangerous region, but it was too near the center to receive the worst effects of the storm. There were numerous wind squalls of considerable destructiveness, and reports indicate that in a number of places within the State small and short lived tornadoes were developed. The town of Akron, Plymouth county, was in the line of a heavy wind-storm on the afternoon of the 11th, and a number of houses and business buildings were demolished. Estimated loss, $50,000, but no lives were lost.

A heavy wind storm, probably a tornado, passed through the townships of Williams and Butler in Calhoun county, and also visited Colfax township, Pocahontas county. The track of the storm was about 80 rods in width, and the damage to property is estimated at $6,000 to $8,000. No lives were lost, but four people received severe injuries.

On the same date a small but vigorous tornado swept a narrow area in Jasper county, passing in a northeasterly direction near Adamson's Grove, about 5 miles southeast of Newton. The destruction of property was comparatively light, but sufficiently heavy for the people who were directly in its pathway. No lives were lost, but one man, a Mr. Hoskins, whose house was demolished, was badly injured, one leg being broken by a falling timber. The storm lifted and disappeared after traversing a short distance.

The second noteworthy storm period covered the dates of April 19th, 20th and 21st. It began with heavy rain and terminated in a snow storm, accompanied by a high and cold wind from the northwest, giving it the character

of a blizzard. In the northern districts the snow was so heavy and drifted so badly, that railway trains were delayed on nearly all the lines traversing that section. The track of its center passed south of Iowa and consequently there was no development of tornadoes within the State. But it was an unusually severe storm for the season of the year, and resultant loss of young stock was quite serious. It was followed by freezing temperature, the minimum recorded at the central station being 22 degrees. Fruit buds were generally not far enough advanced to be badly damaged by the low temperature.

On the morning of April 24, the M. E. church at Orient was struck by lightning and considerably damaged.

On the 11th Mrs. Daniel Heldt, residing near Geneva, Franklin county, was killed by lightning.

SOLAR OBSERVATIONS, APRIL, 1893.—ALTA, IOWA

BY DAVID E. HADDEN.

Date.	CENTRAL TIME.	NUMBER VISIBLE		Faculæ.	Definition.	REMARKS.
		Groups.	Spots.			
1	5:20 P. M.	7	46	4	Good..	A large group of spots is near meridian, with a large spot on meridian near equator. Facula mottling in, by rotation S. E. limb. An extensive area of small spots W. of meridian.
2	4:30 P. M.	8	45	6	Good..	New faculæ by rotation. Faculæ near W. limb.
3	5:15 P. M.	4	.....	3	Fair...	Too windy to count spots. New facula appearing by rotation S. E. limb; the small spots in N. latitude have faded out.
4	11:30 A. M.	5	25	3	Good..	A new group is about one day in, in the faculæ which appeared by rotation S. E. Large spot near W. limb.
5	5:15 P. M.	4	15	4	Poor ..	New group E. limb by rotation. Faculæ S. E. limb.
7	11:20 A. M.	7	25	4	Fair...	A small group by rotation E. limb; also new group about one day in, in same region of faculæ. The large spot on edge of W. limb disappearing by solar rotation. Minute spot in N. W. quadrant.
8	5:15 P. M.	8	25	2	Good..	Train of three groups E. with two large spots. Train of three groups on meridian, extending in N. and S. direction.
10	11:20 A. M.	8	*35	3	Good..	Groups in some relative positions; two large faculæ W.
14	5:15 P. M.	9	*20	5	Fair...	New groups are about two and three days in, on E. limb in faculæ. Three large groups with spots on umbra and penumbra.

SOLAR OBSERVATIONS, APRIL, 1893—CONTINUED.

Date.	CENTRAL TIME.	NUMBER VISIBLE		Faculæ.	Definition.	REMARKS.
		Groups.	Spots.			
15	5:20 P. M.	9	23	4	Good..	Small spot W. latitude on central meridian; also group of small spots S. latitude on meridian. Fine large umbra and penumbra spot E. of meridian.
16	4:20 P. M.	7	20	5	Good..	New group on E. limb; also small prominent faculæ by rotation farther S. Much faculæ in vicinity of groups W. The umbra of the large spot is apparently dividing, a bright streak extending partly across it.
17	5:30 P. M.	6	19	4	Fair...	The large spot is unchanged. New faculæ by rotation E. and S. E. limbs. Small new group about three days from limb.
22	5:15 P. M.	10	44	4	Good..	Group near equator in E. limb; also group by rotation farther West, about two days from limb. Group N. E. limb, in extensive area of faculæ.
23	4:00 P. M.	8	64	4	Good..	Group disappearing by solar rotation. The larger group is N. E.; it has a large spot of umbra and penumbra, and numerous smaller spots.
29	11:20 A. M.	10	35	3	Poor ..	Group by rotation S. E. limb. Five groups are West of meridian N. hemisphere; two groups are S. E., and three N. E. quadrants—all small.

*About.

MARCH METEOROLOGICAL REPORTS.

Reports from the following stations were received too late for publication in last month's REVIEW.

Fayette—Mean temperature 29.4; maximum, 69 on the 31st; mean maximum, 39.7; minimum temperature, 7, on 6th; mean minimum, 19.1; range, 76. Rainfall, 2.21 inches. Snow, 5.4 inches. Wind, SW. Rainy days, 9; cloudy, 15; pt. cloudy, 7; clear, 9; thunderstorms, 2.

Sac City—Mean temperature, 27.6; maximum temperature, 65, on the 31st; mean max., 35.6; minimum, 3, on the 4th; mean min., 19.5; range, 68. Rain, 1.75 inches. Snow, 5.0 inches. Wind, NE. Number of rainy days, 5; cloudy, 20; pt. cloudy, 5; clear, 6; thunderstorms, 1.

METEOROLOGICAL DATA FOR APRIL, 1893.

STATIONS.	TEMPERATURE OF THE AIR (IN DEGREES FAHRENHEIT).								PRECIPITATION IN INCHES.									
		EXTREMES.																
	Monthly mean.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Monthly range.	Monthly, including melted snow.	Total monthly snowfall.	Depth of unmelted snow at end of month.	Prevailing direction of wind.	No. of rainy days. (.01 inch or more).	No. of cloudy days.	No. of fair days.	No. of clear days.	No. of hail-storms.	No. of thunder-storms.
Algona	48.6	* 76	5	.....	* 24	13	.....	52	4.25	.....	.....	NW..	7	11	13	6	1	2
Alta	41.5	79	3	51.0	18	13	32.0	61	3.14	.....	.....	NW..	10	13	10	7	..	5
Ames (W.R. Cooper)	44.0	77	7	56.5	17	15	31.5	60	5.22	.....	.....	NW..	9	15	5	10	..	..
Ames (E. S. King)	.....	.....	.....	.....	.....	.....	.....	.....	5.58	.....	.....	.....	12	.....	.....	.....	..	..
Ames (I. Young)	44.3	* 76	3	.....	* 22	15	.....	54	2.42	.....	.....	SE..	12	6	8	16	..	1
Amana	45.5	83	7	.....	24	9	.....	59	4.68	.....	.....	NW..	11	14	7	9	..	2
Atlantic	47.0	83	5	60.6	18	15	33.5	65	2.68	.....	.....	S.....	10	11	7	12	..	..
Audubon	45.9	76	5	58.0	20	9	33.9	56	3.21	.....	.....	NW..	10	12	15	3	..	1
Belle Plaine	45.0	84	6	55.5	21	6	34.6	63	3.55	5.0	.....	SE...	11	17	5	8	..	..
Blakeville	43.0	.....	.....	.....	.....	.....	.....	.....	3.94	.....	.....	NW..	10	15	14	1	..	3
Bonaparte	48.8	89	7	69.1	23	15	37.6	66	5.11	.....	.....	NW..	13	.....	.....	.....	..	..
Carroll	44.9	75	2	57.9	21	13	33.3	54	3.81	8.0	.....	.....	11	17	7	6	..	..
Cedar Rapids	45.9	78	7	54.7	24	15	37.2	54	3.89	.....	.....	E....	11	13	.....	11	..	..
Centerville	48.2	85	7	60.7	18	15	35.8	67	4.80	6.0	.....	SW..	9	13	7	10	5	3
Charles City	41.7	70	3	49.9	18	15	33.6	52	4.89	8.0	.....	NW..	9	.....	.....	.....	..	2
Clarinda	47.4	81	6	57.2	23	14	37.5	58	3.11	1.0	.....	NW..	6	12	4	14	1	2
Clinton	47.5	87	7	58.3	24	15	36.7	63	5.48	0.5	.....	NW..	10	14	10	6	..	..
College Springs	48.8	* 80	11	59.6	* 24	23	38.0	56	3.80	.....	.....	NW..	9	12	5	13	..	..
Corning (J. W. Bixby)	47.0	79	5	58.3	20	15	35.8	59	3.26	4.0	.....	NW..	9	10	9	11	2	6
Cresco	40.2	77	3	49.0	15	23	31.4	62	5.95	.....	.....	NW..	13	18	10	2	1	3
Davenport	47.0	86	7	55.2	27	14	37.7	59	4.50	.....	.....	E....	12	15	11	4	..	4
Delaware	41.7	* 84	7	.....	* 22	13	.....	62	3.71	3.0	.....	NW..	13	13	9	8	..	..
Denison	46.2	77	5	60.1	21	20	32.3	56	5.18	12.0	.....	NW..	8	11	10	9	..	..
Des Moines	46.0	80	7	54.5	22	15	37.4	58	5.61	3.2	.....	NW..	12	13	11	6	..	4
Dubuque	45.0	80	7	53.1	26	15	37.3	54	4.32	.....	.....	W....	16	18	10	2	..	..
Eagle Grove	40.2	* 66	3	45.8	* 15	9	34.5	51	7.01	10.1	.....	S....	12	15	5	10	..	..
Elkader	43.1	81	3	52.5	22	23	33.6	59	4.50	.....	.....	N....	10	11	12	9	3	..
Emmetsburg	41.2	80	3	52.7	19	13	29.7	61	4.49	7.0	.....	NW..	4	4	12	14	..	..
Fairfield	41.4	86	7	56.4	28	23	42.5	58	8.51	2.3	.....	.....	11	13	7	10	..	..
Ft. Madison	52.4	*80	7	.....	*15	9	.....	74	4.38	..	.....	SW..	11	17	10	3	1	2
Fulton	46.4	*82	7	.....	*30	9	.....	52	3.50	.....	.....	NE...	4	20	10	.....	..	..
Galva	44.1	80	3	55.9	20	13	32.4	60	2.20	4.5	.....	.....	6	8	4	13	..	..
Glenwood	52.0	96	6	64.7	24	9	39.1	72	2.04	.....	.....	E....	8	8	11	10	..	..
Grand Meadow	42.1	*74	30	.....	*26	15	.....	48	4.11	.....	.....	NE...	11	.....	.....	.....	1	2
Greenfield	47.8	80	5	60.1	23	13	35.6	57	3.53	4.1	.....	E....	14	12	4	14	2	2
Grinnell	44.8	74	7	51.9	25	9	37.8	49	3.35	0.8	.....	SE...	9	15	7	8	..	1
Grundy Center	43.6	76	3	52.8	22	14	35.1	54	5.52	7.0	.....	NW..	14	14	9	7	1	3
Hampton	40.7	77	3	50.1	19	14	31.3	58	6.18	8.5	.....	SE ...	12	16	11	3	1	2
Hawkeye	.....	.....	.....	.....	.....	15	.....	.....	4.87	20.0	.....	.....	7	.....	.....	.....	..	..
Hopeville	46.7	79	5	56.6	23	.....	36.7	56	4.03	.....	.....	NW..	12	13	16	1	..	6
Hopkinton	46.0	*78	3	.....	*28	15	.....	50	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Independence	42.3	.....	.....	.....	19	23	.....	.....	1.95	4.0	.....	NW..	4	14	8	8	1	1
Indianola	47.7	81	7	58.1	22	14	37.5	59	5.05	2.0	.....	NW..	10	15	13	2	2	2
Iowa City	48.5	88	7	60.0	24	15	37.0	64	4.37	.....	.....	NW..	12	16	9	5	..	1
Iowa Falls	40.5	76	3	49.6	20	9	31.4	56	4.45	5.0	.....	NW..	13	17	5	8	..	..
Keokuk	49.9	85	7	58.2	27	15	41.6	58	5.41	.....	.....	SE...	16	14	5	11	..	7
Keosauqua	49 9	86	7	59.5	25	15	40.1	61	4.82	.....	.....	.....	12	.....	.....	.....	1	2
Larrabee	42.8	80	3	54.5	18	15	31.0	62	3.93	9.0	.....	NE...	7	11	15	4	1	.
Logan	47.3	86	5	59.4	20	13	35.3	66	2.10	.....	.....	NW..	8	13	6	11	..	..
Maquoketa	45.8	.....	.....	.....	.....	21	.....	.....	4.30	.....	.....	.....	9	.....	.....	.....	..	..
Marshalltown	47.1	78	7	55.7	25	.....	38.3	53	3.98	1.5	.....	S	11	13	5	12	..	..
Maxon	46.6	.....	.....	.....	.....	15	.....	.....	4.63	T	.....	.....	11	12	15	3	..	4
Mechanicsville	44 2	86	7	53.7	23	14	34.8	63	4.24	3.7	.....	NE...	13	17	11	2	..	2
Monticello	43.6	*84	7	53.0	*21	14	34.5	63	3.58	.....	.....	NW..	13	13	7	10	..	..
Mooar	47.0	87	7	58.1	21	14	35.8	66	.....	.....	.....	.....	.....	.....	.....	.....	..	..
Mt. Vernon	47.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	..	..
Mt. Ayr	49.3	83	7	59.6	20	15	38.3	63	3.31	.....	.....	.....	9	18	1	11	..	..
Murray	46.4	77	5	55.9	23	15	36 9	54	4.70	3.0	.....	NW..	11	16	6	8	..	7
Muscatine	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Newton	46.3	82	7	57.6	21	15	35.0	61	5.41	6.0	.....	W ...	12	15	5	12	1	2
Omaha (Neb.)	48.0	82	3	59.0	25	14	38.7	57	3.12	.....	.....	NW..	11	9	7	14	..	..
Osage	38.6	.....	.....	.....	.....	.....	.....	.....	5.14	22.0	.....	.....	12	18	9	3	..	2
Oskaloosa	47.1	85	7	57.7	22	15	36.5	63	3.39	20.0	.....	NW..	6	15	4	11	1	..
Panama	45.8	81	3	57.7	21	12	33.9	60	2.47	2.9	.....	NW..	8	13	7	10	2	1
Richland	47.0	85	7	.....	27	14	.....	58	4.63	.....	.....	.....	7	9	16	5	..	..
Sac City	42.0	66	2	48.9	22	15	35.1	...	2.60	.....	.....	SE...	5	18	7	5	1	..
Seymour	49.2	87	7	61.0	24	14	37.4	63	5.37	1.9	.....	.....	12	.....	.....	.....	1	6
Sioux City	44.6	83	3	54.7	21	13	34.4	62	3.56	.....	.....	NW..	5	13	12	5	..	..
Storm Lake	42.9	78	3	52.9	20	13	32.8	58	2.72	11.1	.....	NW..	8	6	8	8	..	4
Tipton	45.3	86	7	55.2	23	14	35.4	53	4.63	3.7	.....	NW..	13	15	7	8	..	..
Villisca	49.6	82	6	62.1	24	23	37.3	58	1.24	0.3	.....	NW..	5	10	11	4	..	..
Vinton	44.4	* 77	7	.....	* 25	23	.....	52	3.22	10.0	.....	NW..	9	15	2	13	..	4
Washington	49.5	* 84	7	.....	* 32	20	.....	52	4.21	4.0	.....	NE..	13	15	9	6	..	..
Webster City	41.1	* 78	3	.....	* 26	15	.....	52	4.12	3.8	.....	SE..	9	10	13	7	1	3
Williams	41.3	* 75	3	.....	* 20	15	.....	55	5.0	.....	.....	NW..	13	12	9	9	2	3
Winterset	48.3	82	5	56.9	19	15	36.3	53	5 65	.....	.....	NW..	9	16	11	3	2	..
Monthly mean	45.5	96	6	56.2	15	9	35.0	58.3	4.21	6.0	.....	NW..	10.1	13.4	8.7	7.7	1.5	3.0

* Taken from observed readings; all others self-registering instruments.

DAILY AND MONTHLY MEAN TEMPERATURE FOR APRIL, 1893.

STATIONS.	DATE.																														Monthly Mean.
	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	
Algona	39	56	62	54	48	44	61	35	44	54	55	40	27	30	50	47	46	54	40	32	34	32	44	43	42	38	41	38	42	38	48.6
Alta	38	51	63	47	56	44	54	38	40	50	52	38	26	29	41	42	51	48	36	28	31	32	36	47	40	34	40	35	38	36	41.5
Ames (W. R. Cooper)	42	52	57	62	57	48	54	56	40	42	52	50	32	28	38	45	46	44	53	35	29	29	41	34	44	42	44	40	40	39	44.0
Ames (4 miles SW of)	42	58	63	54	55	49	65	43	44	50	52	56	30	30	42	45	44	51	44	30	30	32	40	44	42	37	44	36	40	...	44.3
Amana	42	49	65	52	56	46	66	45	40	48	54	56	34	37	42	50	42	52	48	30	32	33	38	45	44	49	46	44	42	40	45.3
Atlantic	45	56	67	52	62	58	66	46	42	45	61	56	36	33	42	44	55	51	42	34	36	39	39	50	45	44	47	41	40	40	47.0
Audubon	45	55	63	54	58	56	61	48	42	47	60	54	34	35	42	49	56	53	41	30	32	37	42	48	44	41	32	39	38	38	45.9
Belle Plaine	41	50	66	52	56	46	66	44	40	48	54	54	34	31	41	49	43	51	47	31	32	34	38	46	44	49	45	42	40	39	45.0
Blakeville	41	56	61	58	48	42	59	38	41	52	53	46	28	30	44	40	44	53	44	30	32	32	38	44	41	40	41	38	40	35	43.0
Bonaparte	47	50	65	56	61	54	74	52	43	50	56	60	44	35	40	52	46	54	53	40	34	36	42	46	46	50	48	48	45	40	48.8
Carroll	40	65	62	54	55	48	53	48	44	53	42	42	40	48	43	50	52	51	42	32	30	36	41	34	40	35	42	42	45	39	44.9
Cedar Rapids	48	50	60	56	59	44	64	48	44	50	50	51	36	36	39	50	42	56	48	34	33	34	40	44	43	47	44	47	42	40	45.9
Centerville	56	52	65	55	60	56	73	51	42	47	56	56	45	34	32	49	50	50	51	40	33	34	38	42	48	46	44	47	46	40	48.2
Charles City	45	50	58	48	47	40	58	42	38	48	46	54	28	31	34	44	40	47	41	30	32	32	36	42	42	40	42	34	43	38	41.7
Clarinda	46	56	67	55	62	70	66	43	44	48	66	53	33	32	42	48	57	48	41	32	36	36	40	52	44	43	46	42	38	38	47.4
Clinton	49	48	64	54	60	48	68	50	42	54	52	50	40	34	38	53	43	54	49	40	34	34	42	43	43	51	47	48	44	40	47.5
College Springs	45	56	68	58	67	62	62	42	44	48	63	56	37	34	50	52	57	48	44	36	37	42	42	52	46	46	46	46	39	40	48.8
Corning	45	55	66	54	62	60	69	49	42	44	63	59	58	37	40	48	55	49	42	34	36	37	38	49	45	44	46	42	38	38	47.0
Cresco	36	45	60	48	49	37	54	38	40	52	47	46	27	30	38	42	37	50	38	30	30	30	31	39	30	40	40	35	44	36	40.2
Davenport	46	50	64	56	61	45	69	49	42	52	64	60	36	39	40	52	44	54	50	38	34	33	40	42	44	50	46	48	42	40	47.0
Delaware	38	47	61	48	51	40	58	39	39	50	50	47	29	30	37	42	40	50	44	32	31	31	39	41	39	40	42	39	40	37	41.7
Denison	42	56	66	50	58	50	60	48	44	48	59	46	41	38	44	46	51	52	52	34	34	34	...	42	38	42	39	46	42	46.2	
Des Moines	44	54	66	54	60	51	70	43	42	46	54	48	33	31	40	48	52	52	52	32	33	34	39	46	44	45	45	41	41	39	46.0
Dubuque	44	50	68	56	55	40	62	46	42	51	54	58	33	33	38	50	41	51	44	36	33	33	40	42	43	47	44	42	42	38	45.0
Eagle Grove	39	50	58	48	45	42	58	39	32	44	51	40	30	28	35	41	42	47	44	30	29	30	36	42	41	41	35	34	41	39	40 2
Elkader	42	48	65	54	49	40	60	41	39	50	48	50	32	31	36	48	39	48	42	32	33	32	37	41	42	46	44	38	43	39	43.1
Emmetsburg	39	50	60	48	47	41	53	39	46	50	52	44	26	28	40	42	48	48	42	30	31	32	38	43	40	34	39	35	40	37	41.2
Fairfield	46	57	63	68	62	56	70	60	48	48	52	49	40	36	42	40	53	56	47	32	34	34	49	44	46	44	50	50	40	46	49.4
Ft. Madison	60	52	64	57	66	60	75	57	49	56	58	61	44	40	46	57	56	58	53	39	36	38	50	48	48	47	54	53	45	44	52.4
Fulton	39	60	66	53	56	46	68	42	46	52	52	52	34	36	42	48	45	46	46	35	34	34	42	44	44	44	48	45	42	40	46.4
Galva	40	54	62	...	44	...	54	45	41	52	54	50	...	30	44	...	53	52	43	29	30	33	37	52	46	38	44	37	41	...	44.1
Glenwood	49	54	72	56	53	75	72	50	49	72	59	39	34	...	46	56	64	56	44	32	32	33	39	43	42	50	57	48	48	55	41	40	52.0
Grand Meadow	38	54	59	50	50	39	58	38	41	51	50	46	30	31	40	44	42	50	40	32	31	32	38	42	40	39	41	36	44	36	42.1
Greenfield	42	58	56	57	62	58	67	47	44	49	61	56	36	45	48	50	54	52	44	32	32	34	44	47	50	48	47	40	42	38	47.8
Grinnell	42	50	63	52	58	47	62	54	42	50	52	54	34	30	38	48	46	50	46	30	30	32	36	42	42	44	42	43	40	37	44.8
Grundy Center	50	54	64	49	54	42	64	36	42	51	52	41	28	28	40	46	46	51	40	31	31	32	40	44	43	46	46	39	41	37	43.6
Hampton	37	48	61	48	50	40	56	36	38	48	50	44	27	29	36	43	41	48	42	28	28	29	36	40	40	41	40	34	44	36	40.7
Hopeville	43	52	63	56	62	58	68	46	42	48	58	52	36	33	40	50	54	48	44	32	34	36	40	50	46	44	46	42	39	38	46.7
Independence	38	52	60	50	52	38	57	38	43	49	50	48	30	33	40	43	41	50	42	28	31	32	39	41	39	44	46	38	39	37	42.3
Indianola	48	51	66	59	61	53	70	54	42	47	56	56	42	31	40	48	51	51	51	40	32	34	41	46	45	47	46	46	40	39	47 7
Iowa City	52	50	67	56	60	52	69	58	42	49	52	56	45	36	41	51	41	52	52	40	33	34	40	44	45	50	47	48	45	40	48 5
Iowa Falls	38	49	62	48	52	42	56	37	36	48	52	40	28	27	36	36	42	48	42	28	30	28	36	42	40	41	42	34	41	36	48.5
Keokuk	48	54	66	58	65	57	76	52	45	51	58	62	42	33	41	53	52	55	53	34	36	36	41	46	46	52	48	50	43	45	49.9
Keosauqua	47	57	66	57	63	56	77	56	44	49	56	59	48	36	42	53	52	54	54	42	35	36	38	48	47	50	50	51	46	41	49.9
La Crosse, Wis	44	46	60	54	50	36	56	42	44	54	55	48	30	33	38	46	44	50	44	32	34	34	36	42	41	42	42	38	47	40	43 3
Larrabee	40	53	64	47	50	44	54	46	40	50	53	44	29	31	45	43	52	48	40	33	32	32	36	47	42	55	40	36	39	38	42.7
Logan	47	59	68	51	60	57	61	41	46	48	60	50	38	36	46	51	50	56	40	32	31	39	42	55	41	39	42	45	42	40	47.3
Maquoketa	44	54	62	54	52	46	64	44	43	52	60	53	34	34	42	48	47	50	42	32	33	34	43	42	42	47	45	42	41	41	45.8
Marshalltown	52	60	65	64	63	53	62	56	52	53	54	36	33	32	38	44	44	50	52	36	32	33	44	46	44	45	46	44	40	38	47.1
Maxon	38	59	63	57	62	56	67	41	46	51	59	54	32	30	51	48	55	52	41	32	32	32	44	46	44	42	48	44	42	39	46.6
Mechanicsville	42	48	64	51	58	42	66	44	42	49	46	55	34	32	40	48	40	50	46	32	32	31	38	42	44	50	44	44	40	38	44.2
Monticello	39	52	62	50	52	44	62	41	44	48	51	49	34	34	40	44	44	54	43	32	33	34	38	42	41	42	43	43	40	39	43.6
Mooar	41	48	52	57	59	56	66	45	50	54	57	54	36	30	42	46	53	56	45	32	36	34	42	45	44	43	45	46	43	42	47.0
Mt. Vernon	40	55	66	55	59	48	70	40	48	53	52	40	30	33	44	48	47	55	49	32	32	34	42	45	44	43	45	46	43	42	47.0
Mt. Ayr	50	68	66	63	64	62	70	50	44	48	58	...	39	33	40	52	54	52	45	33	36	44	39	50	46	46	46	44	38	39	48.9
Murray	42	53	62	54	60	58	68	44	42	47	57	54	35	31	40	50	54	48	46	31	32	34	39	48	44	46	46	42	39	38	46.4
Newton	42	52	65	52	58	50	60	58	51	48	53	54	34	30	40	48	46	52	48	38	32	34	40	46	44	46	46	43	40	39	46.3
Omaha, Neb	46	60	70	54	62	64	67	49	46	49	64	50	32	33	45	50	60	54	43	36	38	40	42	54	46	38	47	40	40	40	48.0
Osage	35	46	54	42	44	37	52	34	36	46	50	40	26	29	36	38	38	46	42	30	30	32	40	42	39	38	36	37	36	40	38.6
Oskaloosa	44	52	68	52	60	51	71	48	40	46	55	57	39	38	40	50	44	51	51	38	32	34	40	46	46	48	46	47	42	40	47.1
Panama	42	56	66	52	58	56	62	48	42	46	60	42	34	31	43	46	56	56	42	30	32	34	36	40	52	47	38	44	40	38	45.8
Richland	40	54	62	53	60	54	69	44	45	48	53	56	33	34	46	51	50	54	50	32	32	34	38	45	44	43	50	49	42	39	47.0
Seymour	55	52	64	56	64	59	72	50	43	44	54	52	45	33	42	49	50	52	51	39	36	34	51	49	46	47	56	48	44	40	49.2
Sioux City	43	56	65	50	52	50	56	39	40	47	58	40	28	32	47	47	56	55	36	54	36	32	36	46	44	36	41	36	39	40	44.6
Storm Lake	40	50	62	50	51	46	52	49	46	50	50	48	28	28	41	44	50	52	44	30	32	32	36	46	44	36	41	36	39	40	42.9
Tipton	43	50	66	56	59	44	68	49	42	49	46	55	34	32	40	48	40	50	46	32	32	31	38	42	44	48	47	47	42	44	45.3
Villisca	54	48	59	60	57	65	65	56	44	46	44	60	46	37	37	46	52	60	58	46	38	40	38	47	54	51	42	48	46	42	49.6
Vinton	39	56	63	53	54	46	64	40	42	51	56	48	30	32	44	44	43	53	45	30	32	34	38	43	42	41	44	41	41	...	44.4
Washington	46	58	65	58	58	55	76	46	48	54	58	57	38	37	45	49	51	56	52	34	32	32	36	45	42	50	45	50	48	42	49.5
Webster City	43	59	60	53	51	46	54	36	42	53	47	38	27	28	33	37	44	47	40	28	29	35	44	46	41	38	35	34	36	34	41.1
Williams	36	56	59	47	49	44	58	34	44	52	51	41	27	28	41	40	44	50	42	28	26	29	42	42	40	38	39	34	41	35	41.3
Winterset	44	54	66	54	63	55	67	44	42	49	58	54	34	32	40	49	54	50	49	31	33	35	39	46	45	45	46	40	39	38	46.6

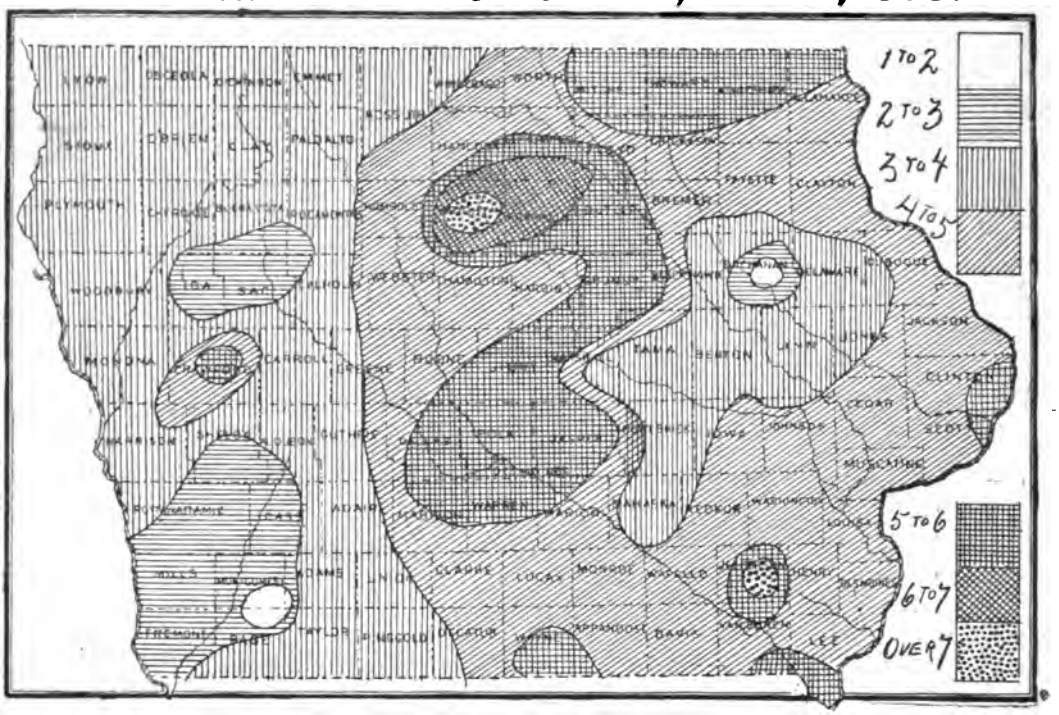
MAXIMUM AND MINIMUM TEMPERATURE FOR APRIL, 1893.

STATIONS.	1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		Monthly Mean.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Alta	46	30	69	32	79	48	60	35	54	37	52	35	68	39	45	30	57	23	68	32	62	42	44	32	34	18	37	21	60	22	55	30	70	32	64	33	40	32	32	25	36	25	38	26	50	32	56	38	41	38	39	30	50	30	38	32	47	30	38	34	51.0	31.1
Ames (W.R.Cooper)	51	34	72	32	74	40	69	53	78	39	57	40	77	32	76	36	60	19	66	18	62	43	62	38	42	23	34	23	60	17	60	26	62	50	59	29	62	44	40	30	35	23	37	21	59	23	51	17	48	39	52	37	54	31	53	35	45	35	42	36	56.5	31.5
Amana	50	35	70	28	79	51	63	42	72	40	54	38	83	50	51	39	56	24	65	31	61	46	65	47	40	28	40	24	54	29	61	39	55	29	63	42	51	46	51	29	35	29	36	30	50	27	50	40	48	40	61	37	56	35	52	37	44	40	43	37	54.6	36.3
Atlantic	57	33	77	35	80	54	73	30	83	40	72	45	78	55	62	29	64	19	68	32	78	44	69	43	46	27	44	32	65	18	64	23	75	35	65	37	51	33	38	29	43	29	50	28	59	19	59	41	47	43	53	36	62	32	47	35	45	34	44	36	60.6	33.5
Audubon	58	32	75	35	75	51	71	37	76	41	67	45	73	49	61	34	65	20	69	25	76	45	65	42	44	23	47	33	64	20	65	33	72	39	67	39	50	32	33	26	39	26	48	26	57	28	57	40	48	41	50	32	40	33	43	35	43	33	42	34	58.0	33.9
Belle Plaine	51	32	71	29	82	49	65	39	72	39	54	37	84	47	52	35	60	21	66	29	62	45	67	42	41	27	40	22	56	26	62	36	50	27	65	37	50	44	52	30	36	29	37	30	52	25	52	39	49	40	62	36	56	34	47	36	42	39	42	36	55.5	34.6
Bonaparte	58	36	72	29	80	50	73	39	77	45	67	40	89	58	64	41	58	28	67	34	68	45	70	50	53	34	45	25	57	23	65	38	63	28	62	45	50	50	50	29	38	29	42	31	56	27	53	40	69	43	62	39	60	35	55	41	50	40	45	36	61.1	37.6
Carroll	48	33	75	55	72	51	71	37	72	38	50	38	72	34	62	34	55	23	70	56	53	30	61	23	58	21	65	31	62	26	68	32	69	35	62	40	52	33	35	28	33	28	39	33	58	24	42	36	45	34	42	28	52	33	50	33	52	38	42	36	57.9	33.3
Cedar Rapids	56	40	65	34	77	42	67	44	71	47	50	38	78	50	54	42	56	32	65	36	60	40	54	48	43	30	46	26	50	24	65	36	50	35	68	44	51	46	35	32	36	30	38	31	51	29	50	27	46	40	60	34	54	35	55	39	45	40	44	36	54.7	37.2
Centerville	84	52	71	33	76	54	68	42	78	42	69	43	85	61	64	38	68	28	65	29	76	48	66	46	58	32	43	25	60	18	64	34	66	34	58	42	54	48	52	28	38	28	40	28	54	32	54	30	62	34	60	32	58	30	54	40	53	30	44	36	60.7	35.8
Charles City	60	30	66	35	70	46	60	36	60	34	48	33	68	48	50	34	56	21	57	40	48	44	62	46	34	32	35	27	50	18	58	30	49	30	60	34	44	38	33	28	34	30	36	28	48	25	45	38	46	37	45	35	50	35	37	32	50	36	38	37	49.9	33.6
Clarinda	54	38	74	37	78	56	67	43	77	46	81	59	76	56	50	36	59	28	64	31	77	55	63	43	37	29	41	23	60	24	62	35	71	43	54	53	50	32	37	28	42	29	48	24	54	25	62	41	46	43	48	38	58	33	48	36	40	35	39	36	57.2	37.5
Clinton	59	39	70	26	79	50	68	41	77	43	60	35	87	49	62	38	58	27	69	39	62	41	69	49	49	31	39	28	53	24	65	41	57	29	66	43	54	44	47	32	39	30	37	30	56	29	52	34	46	40	62	40	58	36	57	38	48	39	44	36	58.3	36.7
College Springs	56	34	75	36	79	56	72	43	78	56	79	46	76	48	52	33	59	28	66	31	80	46	68	44	41	33	44	24	65	36	66	38	73	41	55	42	45	43	38	35	55	29	55	28	59	24	62	42	48	43	53	39	62	31	54	39	41	37	43	36	59.6	38.0
Corning	55	35	73	57	76	56	69	39	79	45	75	45	77	61	65	33	58	25	62	27	76	50	69	45	48	29	41	25	60	20	65	31	70	40	56	40	52	32	37	30	42	29	47	21	53	22	58	40	49	41	53	34	58	33	48	37	42	35	40	35	58.3	35.8
Cresco	42	29	64	26	77	42	59	39	60	38	43	31	70	38	44	35	58	21	66	37	55	39	57	34	32	32	34	25	50	25	53	22	48	26	63	28	41	36	31	28	33	27	34	26	47	15	43	35	43	35	47	33	49	32	37	33	53	35	37	34	49.0	31.4
Davenport	53	38	67	33	76	52	66	47	73	49	54	36	86	52	55	43	52	31	63	42	65	43	66	54	41	31	37	27	51	28	61	43	55	33	63	44	52	49	45	32	36	31	35	31	49	30	48	37	46	41	60	40	56	37	56	41	46	39	44	36	55.2	37.7
Denison	52	32	75	38	82	51	66	35	77	39	60	40	75	46	62	33	65	22	66	30	75	43	67	26	60	32	52	23	64	23	61	32	70	32	66	39	72	52	47	21	40	27	44	24	53	24	58	..	43	40	44	32	52	32	44	34	61	32	49	34	60.1	32.3
Des Moines	51	36	72	37	76	56	66	42	75	45	61	41	80	60	49	37	55	29	63	30	67	40	49	47	39	27	36	26	58	22	59	38	66	37	59	44	53	50	33	30	37	29	39	30	52	26	52	40	47	41	56	34	55	35	44	38	44	38	42	36	54.5	37.4
Dubuque	52	37	68	31	80	55	64	47	68	42	45	34	80	43	52	40	54	29	64	38	62	46	67	50	38	28	38	28	50	26	58	42	49	33	61	41	46	43	40	32	36	30	36	30	50	30	46	38	46	40	56	38	54	35	46	38	45	40	42	35	53.1	37.3
Elkader	54	31	71	25	81	49	68	40	65	33	46	33	81	40	45	37	54	24	68	31	52	44	61	40	37	26	38	24	50	23	59	38	52	26	66	37	45	40	35	30	37	29	36	29	52	22	44	38	47	37	53	38	54	35	41	35	48	38	42	36	52.5	33.6
Emmetsburg	48	30	71	30	80	40	63	34	62	32	48	34	70	36	50	28	60	20	69	30	62	41	62	26	33	19	35	22	60	20	53	30	63	32	65	32	52	31	35	25	35	27	38	26	53	23	48	38	44	35	40	29	49	29	39	31	49	30	43	31	52.7	39.7
Fairfield	50	42	68	46	74	52	77	50	74	51	75	42	86	72	78	42	56	40	50	46	61	48	47	41	43	36	41	30	54	31	69	50	58	48	61	50	50	44	34	30	34	33	37	32	65	28	48	39	49	43	51	38	57	43	54	46	42	40	50	41	56.4	42.5
Galva	48	32	72	35	80	45	..	..	56	32	..	..	68	40	60	30	62	20	68	36	64	43	64	35	..	..	38	23	66	32	..	..	71	35	67	36	54	32	32	26	34	26	39	27	52	32	63	40	52	40	44	32	55	32	40	34	48	34	..	..	55.9	32.4
Glenwood	60	38	66	42	83	68	70	43	60	46	96	54	80	64	66	34	72	26	82	62	72	46	48	30	44	24	..	..	68	24	78	34	85	42	67	45	52	36	40	32	48	28	58	28	60	24	76	42	68	46	52	28	62	34	72	38	46	36	43	38	64.7	39.1
Greenfield	53	32	74	38	79	54	74	40	80	44	71	44	78	56	60	34	68	29	76	46	70	43	58	25	27	66	24	62	34	63	36	74	34	65	38	56	32	37	37	28	36	24	54	28	36	57	42	52	32	62	32	45	36	48	35	42	34	40	36	60.0	35.6
Grinnell	47	38	65	35	72	54	62	43	70	46	54	40	74	50	68	41	52	32	60	40	58	45	61	46	37	31	35	25	50	26	56	41	55	36	56	44	49	44	46	29	32	29	34	30	45	26	45	40	45	39	51	38	50	34	49	37	40	39	39	35	51.9	37.8
Grundy Center	67	32	69	39	76	53	62	36	69	38	48	30	71	58	47	24	54	30	66	36	60	45	58	24	30	26	44	22	53	28	56	37	52	39	60	42	47	32	32	30	32	30	35	28	49	31	48	39	46	40	56	36	54	38	42	36	44	38	38	36	51.8	35.3
Hampton	45	29	68	27	77	46	61	35	67	34	47	33	73	39	43	30	54	21	65	32	59	42	54	34	32	22	43	23	55	23	63	33	54	28	63	35	45	38	33	25	33	23	45	28	63	33	57	43	43	37	51	31	50	31	53	35	43	28	53	33	50.1	31.3
Hopeville	54	32	71	34	72	54	69	44	79	45	72	45	79	57	57	35	56	28	64	32	69	46	63	41	41	31	41	25	56	23	63	37	69	39	54	43	52	36	36	28	40	28	41	30	54	26	57	42	49	42	53	35	68	34	47	38	41	37	41	36	56.6	36.7
Independence	65	34	70	32	78	58	68	38	70	38	56	43	81	48	64	37	52	31	64	37	55	44	..	..	38	..	19	..	25	..	23	..	26	..	36	..	39	..	37	..	25	..	21	..	34	..	36	..	37	..	32	..	33	..	36	..	33	..	.....	.....	33.7	
Indianola	62	33	72	39	75	58	73	44	76	46	64	42	81	57	72	37	56	27	63	31	67	45	66	46	50	28	36	26	58	22	60	37	66	37	60	42	52	50	51	28	36	28	38	30	55	27	50	41	49	41	56	37	56	34	54	38	42	38	42	36	58.1	37.5
Iowa City	69	36	74	27	83	51	68	43	75	46	66	37	88	50	75	40	59	24	67	31	61	44	68	44	61	29	46	25	53	29	63	39	54	28	63	42	57	48	49	31	37	29	37	30	52	27	50	39	50	40	39	40	58	36	57	38	50	40	45	36	60.0	37.0
Iowa Falls	45	31	68	30	76	48	60	35	77	38	49	34	72	40	46	28	52	20	66	31	60	43	46	35	33	32	30	24	52	20	53	29	54	29	60	35	44	40	30	26	34	26	31	26	50	22	45	39	42	37	50	32	53	31	36	32	48	34	37	34	49.6	36.4
Keokuk	56	39	70	37	75	56	69	47	78	52	71	43	85	68	59	45	53	37	62	40	70	46	70	54	46	38	39	27	55	27	64	43	65	38	63	47	55	51	38	31	40	31	40	33	53	29	51	41	49	44	61	44	60	37	55	45	45	41	48	38	48.2	41.6
Keosauqua	58	36	73	41	78	53	71	43	78	58	68	43	86	68	69	43	55	32	66	32	67	46	68	50	58	37	44	27	58	25	66	40	62	43	64	47	55	52	53	31	39	31	40	32	57	27	52	43	49	45	59	40	63	36	58	44	50	41	45	36	59.5	40.1
La Crosse, Wis	44	35	64	29	76	44	66	42	63	38	42	31	75	38	46	39	56	31	66	42	64	46	56	41	32	27	39	27	49	26	53	39	56	32	59	40	47	40	34	30	37	31	38	30	48	25	45	38	46	36	48	36	50	34	42	35	56	38	44	37	51.4	35.2
Larrabee	49	30	71	35	80	48	65	29	65	35	54	34	69	40	64	37	61	19	69	30	63	43	59	30	40	18	40	22	64	26	55	31	71	33	65	32	47	32	35	31	38	26	39	25	51	21	55	39	47	38	40	30	49	32	41	32	48	30	42	33	54.5	31.0
Logan	60	34	78	40	82	55	68	34	86	34	58	46	76	46	46	36	68	24	70	25	72	47	56	44	48	27	48	24	65	28	68	34	76	42	82	40	48	31	34	30	42	20	50	28	59	24	68	42	44	38	40	38	50	34	50	40	48	35	41	38	59.4	35.3
Marshalltown	69	36	70	50	73	52	76	58	68	59	80	37	78	47	74	39	60	43	62	34	63	45	46	32	40	26	35	28	50	25	55	32	55	33	59	40	59	46	47	30	35	29	36	30	52	27	51	40	49	39	56	34	50	43	53	36	44	37	40	35	55.7	38.3
Mechanicsville	51	33	68	28	79	48	62	40	73	42	51	33	86	46	51	38	57	26	62	36	65	36	63	47	40	28	41	23	51	28	58	37	52	29	60	39	50	41	35	28	35	28	35	27	49	26	48	35	52	37	58	42	53	34	51	37	43	37	43	34	53.7	34.8
Moar	57	25	70	25	72	33	70	44	77	41	67	45	87	44	60	30	71	28	64	44	68	46	68	39	47	26	39	21	56	27	63	29	62	44	61	50	56	34	35	30	39	32	42	30	50	33	50	40	53	43	53	35	60	40	48	42	46	35	52	40	58.1	35.8
Mt. Ayr	60	40	75	60	75	56	70	56	81	46	77	48	83	58	60	40	56	31	64	32	72	44	65	..	47	31	42	24	59	20	67	38	69	39	57	46	58	34	36	30	42	29	59	28	54	24	60	41	51	41	55	36	60	32	52	37	41	36	43	35	59.6	38.3
Murray	53	32	70	36	71	54	67	41	77	44	72	45	71	64	53	35	56	37	63	31	69	45	63	45	40	30	38	24	57	23	62	38	69	38	56	41	52	41	35	29	40	27	41	29	53	25	54	41	47	42	56	35	56	33	46	38	41	37	41	35	55.9	36.9
Newton	52	33	72	32	79	51	67	38	74	41	62	39	82	39	57	37	78	24	66	36	60	44	64	45	45	25	30	25	58	21	58	37	62	30	61	43	51	45	46	29	37	28	38	29	53	26	53	41	43	41	47	34	49	37	42	37	43	35	57.6	35.0
Omaha, Neb	56	37	77	43	81	59	67	42	75	49	81	48	73	61	47	34	60	32	62	36	81	46	55	45	37	26	41	25	63	27	62	38	76	43	64	44	58	36	39	44	45	30	51	29	57	28	65	43	47	44	43	33	58	36	41	38	45	36	41	38	59.0	38.7
Oskaloosa	54	33	74	31	79	56	68	37	77	42	63	39	85	53	65	28	65	45	67	47	48	30	41	26	37	26	32	25	57	25	60	38	58	25	63	45	49	28	29	45	29	30	50	33	56	31	54	40	44	40	42	37	57	39	34	54	40	44	42	37	57.7	36.5
Panama	52	33	73	38	81	50	68	37	74	42	69	43	72	51	62	33	59	25	63	28	76	44	64	21	44	23	40	22	62	23	59	33	73	40	70	41	52	32	34	29	39	28	44	26	54	25	64	41	52	42	45	32	55	33	45	34	44	33	42	35	57.7	33.9
Seymour	75	35	72	32	74	53	72	40	83	45	74	44	87	58	68	32	54	32	58	30	68	40	73	42	60	30	42	24	57	28	63	35	66	34	63	40	54	48	50	28	46	26	42	27	55	48	55	42	53	40	58	35	59	34	56	40	49	40	45	36	61.0	37.4
Sioux City	53	33	73	40	82	48	64	37	65	40	62	38	67	46	47	31	56	25	62	32	67	44	47	30	28	24	31	23	51	28	58	35	72	39	60	39	50	41	35	28	35	28	37	27	47	24	51	41	42	40	42	32	45	32	35	32	42	35	52	34	52.7	34.5
Storm Lake	48	33	63	32	78	43	64	36	65	35	54	37	65	40	66	32	66	27	65	34	56	43	62	35	36	20	37	20	57	25	55	34	65	34	61	44	54	53	33	26	35	25	38	27	48	24	51	40	49	38	41	31	49	33	39	33	41	31	43	36	53.0	32.8
Tipton	53	33	70	30	79	52	68	43	74	44	54	35	86	49	66	32	57	26	62	36	56	35	66	37	47	28	41	23	51	28	58	37	52	29	60	39	50	41	35	28	35	28	35	27	49	26	48	35	52	37	58	39	58	36	55	39	46	29	47	40	55.2	35.4
Villisca	76	31	63	32	76	42	80	39	65	49	82	48	75	55	77	34	58	29	60	32	63	33	80	41	62	31	47	27	52	32	63	30	64	46	72	48	59	46	59	32	45	32	50	30	51	24	58	36	60	47	55	47	54	31	61	36	52	40	45	40	62.1	37.3
Winterset	54	33	73	36	77	55	70	39	82	44	66	44	79	55	54	34	60	25	67	31	70	45	64	45	41	28	39	25	61	19	63	35	70	39	60	41	53	45	33	29	39	27	40	30	53	25	53	40	47	43	55	35	59	34	43	38	42	36	40	35	56.9	36.3

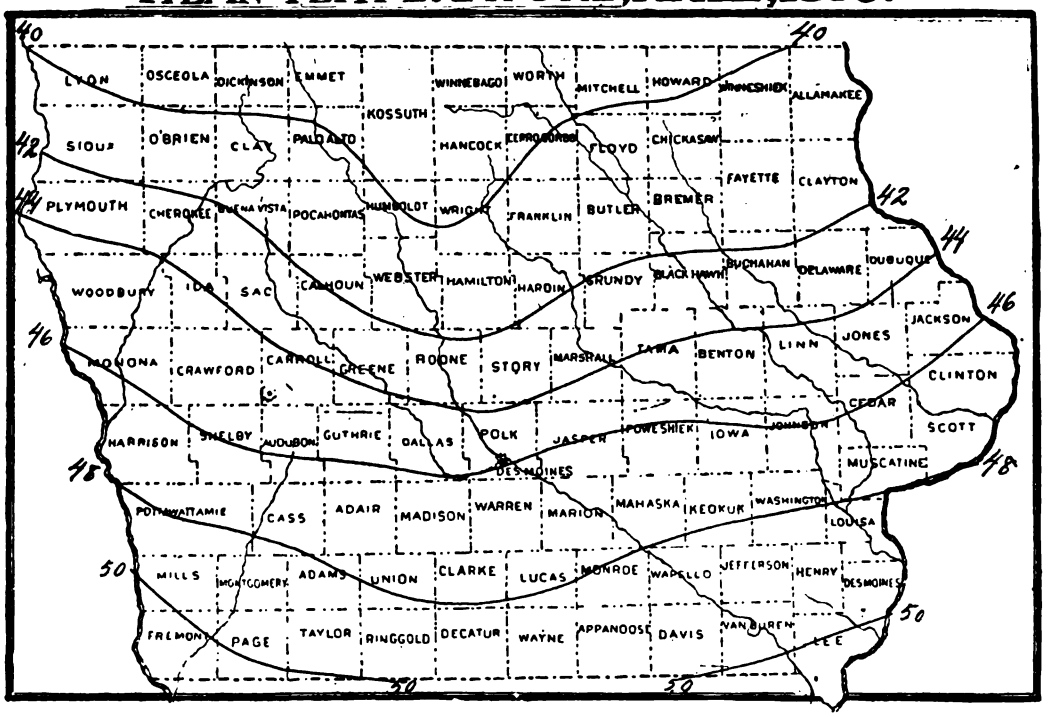
DAILY AND MONTHLY PRECIPITATION FOR APRIL, 1893.

STATIONS.	DATE.																																						Total.
	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	
Algona	....	....	....	....	....	....	....	....	....	....	....	....	T	....	....	....	T	....	1.10	0.60	....	....	....	....	0.25	0.90	....	0.60	....	0.80	4.25
Alta	....	....	....	....	....	....	....	....	....	....	0.29	....	....	....	0.01	....	T	....	0.88	0.53	0 01	....	....	T	....	1.11	0.16	0.06	....	0.08	3.14
Ames (King)	....	....	....	....	....	....	....	....	....	....	0.26	....	....	....	0.15	....	0.65	0.23	0.98	0.30	T	....	....	0.21	0.09	0.19	....	0.21	0.60	1.71	5.58
Ames (Cooper)	....	....	....	....	....	....	....	....	....	....	0.40	....	....	....	....	....	0.17	0.70	....	....	1.35	....	....	....	0.27	0.31	....	0.27	0.05	1.70	5.22
Ames (Young)	....	....	....	....	....	....	....	....	....	....	0.20	....	....	....	0.05	....	0.25	....	1.55	....	0.20	....	....	0.07	....	0.10	....	....	....	....	3.85
Amana	....	....	....	....	....	....	....	....	....	....	.39	.78	....	....	....	....	....	.10	.52	1.60	.06	T	....	.17	.03	.18	....	.43	....	.42	4 68
Atlantic	....	....	....	....	....	....	....	....	....	0.10	0.21	....	....	....	T	....	....	0.25	0 28	0.14	....	....	....	0.47	T	0.20	....	0.38	0.11	0.50	2.68
Audubon	....	....	....	....	....	....	....	....	....	....	0.57	....	....	....	0.18	....	....	0.02	0 80	0 56	....	....	....	0.28	....	0.46	0.25	0.05	0.04	....	3.21
Belle Plaine	....	....	....	....	....	....	....	....	....	....	0.30	....	....	....	....	....	0.18	0.40	0.15	1.10	0.20	....	....	0.24	T	0.75	....	0.30	0.40	0.13	3.55
Blakeville	....	....	....	....	....	0.50	....	....	....	....	0 25	....	....	....	....	....	....	0.24	0.70	0 72	0.11	....	....	0.20	....	0.23	....	0.15	....	0.84	3.94
Bonaparte	....	....	0.07	....	....	....	....	....	0.02	0.70	0.70	....	....	....	....	....	0.10	0.45	1.20	0.20	....	....	....	0.67	0.15	0.14	....	0.10	0 51	0.10	5.11
Carroll	....	....	....	....	....	....	....	....	....	....	0.50	....	....	....	0.05	....	0.80	....	1.30	....	....	....	....	0.18	....	0.60	....	0 20	....	0.18	3.81
Cedar Rapids	....	....	....	....	....	....	....	....	....	....	0.25	0.62	....	....	....	....	....	0.50	0.41	0.73	0.21	0 05	....	0.06	0.12	0.07	0.18	0.06	0.17	0 46	3.89
Centerville	....	....	0.10	....	....	....	....	....	T	....	0.45	0.50	T	....	....	....	....	....	0.50	1 00	0.10	T	....	0.60	T	....	....	0.50	....	1.05	4.80
Charles City	....	....	....	....	....	....	0.62	....	....	....	1.12	....	....	....	T	....	0.09	0.36	....	1.35	....	....	....	....	0.07	0.32	T	0.43	....	0.53	4.89
Clarinda	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.30	....	0.55	....	....	....	0.51	....	0.26	....	0.29	1.20	....	3.11
Clinton	....	....	....	....	....	....	....	....	....	....	2.08	....	....	....	....	....	0.25	....	0.25	1.45	....	0 19	....	0.06	....	0.57	....	0.13	0.06	0.44	5.48
College Springs	....	....	....	....	....	....	....	....	....	....	....	....	....	T	....	....	....	0.35	0.82	0.13	....	....	....	0.40	T	9.33	....	0.18	0.76	0.43	3.80
Corning	....	....	T	....	....	....	....	....	....	....	0.15	....	....	....	T	....	T	0.33	0.48	0.40	....	....	....	0.83	....	0.35	....	0.67	0.05	0.50	3.76
Cresco	....	T	....	....	....	0.12	....	....	....	....	1.75	T	....	....	0.03	....	0.06	....	....	1.51	0 35	T	....	0.15	....	0.50	0.02	0.54	....	0.92	5.95
Davenport	....	....	....	T	....	....	....	....	....	....	0.85	1.36	....	....	....	....	T	0.15	0.43	0.85	0 16	0.02	....	0.05	T	0 22	T	0.21	0.04	0.15	4.50
Delaware	....	....	....	....	....	0.05	....	....	....	....	0.36	....	....	....	....	....	0.05	0.72	1.23	0.31	0.04	....	....	0.07	0.06	0.40	....	0.08	0.19	0.15	3.71
Denison	....	....	....	....	....	....	....	....	....	....	0.91	....	....	....	1.00	....	1.00	T	0.07	0.98	T	....	....	0.17	T	0.83	....	....	T	0.22	5 18
Des Moines	....	....	....	....	T	....	T	....	....	....	0 31	T	....	T	....	0.02	0.04	0.18	0.56	1.41	0.01	T	....	0.38	T	0.31	....	0.40	0 68	1.91	5.61
Dubuque	....	....	....	....	....	....	0.06	....	....	....	0.34	0.86	....	....	....	....	0.22	0.08	0.21	1.56	0 18	0.01	....	0 04	0.04	0.40	0.02	0.06	0.02	0.22	4.32
Eagle Grove	....	....	....	....	....	T	....	....	....	....	1.50	....	....	....	0.40	....	....	....	1.00	0 50	0.50	....	....	0.01	0.50	1.50	0.50	0.50	....	0.10	7.01
Elkader	....	T	....	....	....	0.47	....	....	....	....	0.81	....	....	....	T	T	0.25	....	1 49	1.04	0.13	T	....	0.04	....	0.40	T	0.12	....	0.75	4.50
Emmetsburg	....	....	....	....	....	....	....	....	....	....	1.39	....	....	....	....	....	....	....	1.00	0.80	....	....	....	....	1.20	....	....	0.10	....	....	4.49
Fairfield	....	....	....	....	....	....	....	....	....	1.60	1.36	....	....	....	....	....	....	0 45	0.60	0.24	0.10	T	....	1.80	T	1.24	....	0.22	0.40	1.50	8.51
Ft. Madison	....	....	0.40	....	....	....	....	....	0.18	....	1.47	....	....	....	....	....	0.22	0.60	....	1.35	....	....	....	0 51	....	0.18	....	0.13	0.32	0.21	4.38
Fulton	....	....	....	....	....	....	....	....	....	....	....	1.00	....	....	....	....	....	....	....	....	1.40	....	....	....	....	0.70	....	....	0.40	....	3.50
Galva	....	....	....	....	....	....	....	....	....	....	0.20	....	....	....	....	....	....	....	0.70	0.30	0.05	....	....	....	0.60	0 35	....	....	....	....	2.20
Glenwood	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.18	0.18	....	....	....	....	1.10	0.08	0.33	....	0.13	0.03	0.01	2.04
Grand Meadow	....	T	....	....	....	0.04	0.23	....	....	....	0.68	....	....	....	0.03	....	0.23	....	....	0.96	0.24	T	....	0.09	....	0.61	....	0.40	....	0.60	4.11
Greenfield	....	T	....	....	....	....	....	....	....	....	0.14	0.02	....	T	....	....	T	0.41	0.45	0.40	0.01	0.04	0.45	0.01	0.44	....	0.50	0.05	0.01	0.60	3.53
Grinnell	....	....	....	....	....	....	....	....	....	....	0.40	....	....	....	....	....	....	0.35	0.40	....	0.50	....	....	....	0.70	0.13	0.02	0.50	0.35	....	3.35
Grundy Center	....	....	....	....	....	0.16	....	....	....	....	0.57	....	....	....	0.04	....	0.35	0.13	1.53	0.08	....	....	....	0.10	0.09	0.09	0.07	0.07	0.48	1.76	5.52
Hampton	....	T	....	....	....	0.65	....	....	....	....	1.26	....	....	....	0.16	....	0.03	....	2.00	....	0.38	....	....	0.07	0.10	0.16	....	0.40	....	0.95	6.18
Hawkeye	....	....	....	....	....	0.32	....	....	....	....	0.60	....	....	....	T	....	....	....	....	0.66	0.75	T	T	T	....	0.80	....	0.84	....	0.92	4.87
Hopeville	....	....	0.07	....	T	....	....	....	....	....	0.61	....	....	....	....	0.03	T	0.27	0.46	0.27	T	T	....	0.58	0.15	0.02	....	0.75	0.13	0.60	4 03
Independence	....	....	....	....	....	0.25	....	....	....	....	T	....	T	....	....	....	T	....	....	1.00	....	....	T	T	....	....	....	T	....	0.70	1 95
Indianola	....	....	....	....	T	....	....	....	....	....	0.63	0.26	....	....	....	....	....	0.28	0.39	0.83	T	T	....	0.63	T	0.26	....	0.26	0 06	1.45	5.05
Iowa City	....	....	....	....	....	....	....	....	....	....	0.78	0.70	....	....	....	....	0.10	....	0.48	0.98	0.09	....	....	0 24	0.18	0.10	....	0.44	0.16	0.12	4.37
Iowa Falls	....	....	....	....	....	0.03	....	....	....	....	1.17	....	....	....	0.18	....	0.05	0.15	1.15	0.36	0.21	....	....	0.06	0 18	0.07	....	0.06	....	0.76	4.45
Keokuk	....	....	0.12	....	....	....	....	....	0.02	0.10	0.56	0.82	....	T	....	....	0.01	0.29	0.82	0.93	T	0.02	....	0.83	0.03	0.16	....	0 06	0.42	0.24	5.41
Keosauqua	....	....	0.28	....	....	....	....	....	....	....	0 46	0.68	T	....	....	....	T	T	0 50	1.28	T	T	....	0.78	T	0.15	....	0.06	0.28	0.35	4.82
La Crosse, Wisconsin	....	0.01	0.01	....	....	0.08	0.05	....	....	....	0.68	0.06	T	....	....	0.15	T	T	0.15	0 75	0.32	0 01	....	0 06	0 19	.81	0.08	0.22	0.06	0 11	3.80
Larrabee	....	....	....	....	....	....	....	....	....	....	1.52	T	T	....	T	....	T	T	0 85	0.45	0.10	....	T	....	0.60	0.22	....	0 19	....	T	3.93
Logan	....	....	....	....	....	....	....	....	....	....	0.48	....	....	....	0.07	....	....	....	0.33	....	....	....	....	0.30	0.15	0.52	....	0.15	....	0.10	2.10
Maquoketa	....	....	....	....	....	T	....	....	....	....	1.15	....	....	....	....	....	0.45	....	0.65	1.35	0.18	T	....	....	0.12	0.15	....	0.03	T	0.22	4.30
Marshalltown	....	....	....	....	....	....	....	....	....	0.90	....	....	....	....	....	....	....	0.65	0.64	0.70	....	....	....	0.24	0.10	....	....	0.41	....	0.34	3.98
Maxon	....	....	T	....	....	....	....	....	....	....	0.62	0.60	....	....	....	....	....	0.33	0.43	0.75	T	T	....	0.87	T	0.13	....	0.21	0.40	0.83	4.63
Mechanicsville	....	....	....	....	....	....	....	....	....	0.94	1.15	....	....	....	....	....	0.45	0 40	0.15	1 20	0.12	0.02	....	0.04	0.02	0.42	....	0 06	0.09	0.12	4.24
Monticello	....	....	....	....	....	0.06	....	....	....	....	0.28	0.63	....	....	....	....	0 34	....	0.40	0.85	0.04	T	....	0.09	....	0.48	....	0.06	0 13	0.24	3.58
Mooar	....	....	....	....	....	....	....	....	....	....	1.08	....	....	....	....	....	0 18	0.94	0 85	0.08	....	0.14	0.10	0.80	0 25	0.08	....	0.13	0.52	0.15	6.24
Mt. Ayr	....	....	....	....	....	....	....	....	....	....	0.44	....	....	....	....	....	T	0.43	0.50	0.04	T	....	....	0.26	T	0.38	....	0.56	0.16	0.54	3.31
Murray	....	....	0.05	....	T	....	....	....	T	....	0.66	....	....	....	....	T	T	0.38	....	0.92	0.02	T	....	0.59	0.02	0.38	....	0.58	0.08	1.02	4.70
Newton	....	....	T	....	T	....	....	....	....	....	0.77	....	....	....	....	....	0.04	0.29	0.41	1.46	0.12	T	....	0.37	0.17	0.03	....	0.42	0.13	1 20	5.41
Omaha, Nebraska	....	....	....	....	....	....	....	....	....	....	0.62	....	....	....	T	T	....	0.01	0.09	0.01	0.01	....	....	1.60	0.01	0.61	....	0.13	0.01	0.02	3.12
Osage	....	....	....	....	....	0.15	....	....	....	....	1.05	0.26	....	....	....	....	....	T	....	0.28	1.65	....	....	0.06	0.06	0.45	0.42	0.61	0.07	0.08	5.14
Oskaloosa	....	....	....	....	....	....	....	....	....	....	0.50	....	....	....	....	....	....	....	....	....	1.12	....	....	0.75	0.20	....	....	0.20	....	0.62	3.39
Panama	....	....	....	....	....	....	....	....	....	....	0.83	....	....	....	0.06	....	....	....	....	0.45	....	....	0.30	....	....	0.50	0.15	....	....	0.10	2.47
Richland	....	....	....	....	....	....	....	....	....	....	1.05	....	....	....	....	....	0.08	T	....	....	1.47	T	....	0 64	....	0.41	....	0.21	....	0.77	4.63
Seymour	....	....	0.18	....	....	....	....	....	....	....	0.88	....	....	....	....	....	....	....	0.33	0.92	0.19	0.23	....	0.63	....	0.13	....	0.54	0.41	0.90	5.18
Sioux City	....	....	....	....	....	....	....	....	....	....	0.85	....	....	....	....	....	....	....	0.74	T	T	....	....	T	0.29	1.55	....	....	....	0.13	3.56
Storm Lake	....	....	....	....	....	....	....	....	....	....	0.24	....	....	....	T	....	T	....	0.56	0.93	T	....	....	....	0.07	0.62	0.18	0.06	....	0.06	2.72
Tipton	....	....	....	....	....	....	....	....	....	....	1.15	....	....	....	....	....	0.45	0.40	0.15	1.20	0.12	0.02	....	0 04	00.2	0.35	....	0.35	0.22	0.16	4.63
Villisca	....	....	....	....	....	....	....	....	....	....	T	....	....	....	....	....	T	0.34	0.20	0.03	....	....	....	T	....	T	....	0.44	0.27	....	1.24
Vinton	....	....	....	....	....	....	....	....	....	....	0.30	....	....	....	....	....	0.53	....	0.50	1.30	0.80	....	....	0.20	T	0.13	....	0.16	0.10	....	3.22
Washington	....	....	....	....	....	....	....	....	....	....	0.45	....	....	....	....	....	....	0.40	0.33	....	1 00	....	....	0.38	0.30	0.30	....	0.24	0.30	.60	4.21
Webster City	....	....	....	....	....	0.12	....	....	....	....	....	....	....	....	0 25	....	0.11	T	....	....	....	1.00	....	0.25	0.50	0.50	....	0.25	....	0.25	4.12
Williams	....	....	....	....	....	0.22	....	....	....	....	1.52	....	....	....	0.22	....	0.03	....	1.47	....	0.13	....	....	0.05	0.21	0.11	....	0.14	T	0.90	5.00
Winterset	....	....	....	....	....	....	....	....	....	....	0.35	....	....	T	....	....	....	0.37	1.25	0.40	T	....	....	0.75	T	0.35	....	0.40	0.23	1.55	5.65

IOWA PRECIPITATION CHART, APRIL, 1893.



MEAN TEMPERATURE, APRIL, 1893.



METEOROLOGICAL STATIONS AND OBSERVERS.

From the following, weekly and monthly reports of Meteorological data are received by the Iowa Weather and Crop Service.

Albia	Geo. Price.
Algona	C. D. Pettibone.
Alta	D. E. Hadden.
Amana	Conrad Schadt.
Ames	E. C. Dickinson.
Ames	E. N. Eaton
Ames, (4 miles S. W.)	Isaac Young.
Atlantic	J. W. Love.
Audubon	J. F. Hocker.
Belle Plaine	H. W. Vandike.
Blakeville	James Rodgers.
Blockton	C. W. Thompson.
Bonaparte	Hon. B. R. Vale.
Carroll	Moses Simon.
Cedar Falls	Prof. A. C. Page.
Cedar Rapids	H. D. Olds.
Centerville	J. I. Ong.
Charles City	J. W. Smith.
Clarinda	A. S. Van Sandt.
Clinton	Luke Roberts.
College Springs	A. A. Berry.
Concord	J. M. Elder.
Corning	John W. Bixby.
Corning	Jerome Smith.
Corydon	J. S. Whittaker.
Cresco	Gregory Marshall.
Davenport	*F. J. Walz.
Delaware	Wm. Ball.
Denison	P. H. Schlumberger.
Des Moines	Geo. M. Chappel, M. D.
Dubuque	*S. C. Emery.
Eagle Grove	C. A. Schaffter.
Eldora	Prof. C. F. Woodward.
Elkader	Chas. Reinecke.
Emmetsburg	H. Conroy.
Estherville	R. M. McKean
Fairfield	J. Fred Clarke, M. D.
Fayette	R. Z. Latimer.
Ft. Madison	Miss L. A. McCready.
Galva	Dr. D. W. Farnsworth.
Glenwood	Seth Dean.
Greenfield	J. G. Culver.
Grinnell	Prof. S. J. Buck.
Grundy Center	Chas. G. Rogers.
Hampton	E. C. Grenelle.
Havelock	P. H. Coquillette.
Hawkeye	J. W. Bopp.
Hopeville	M. T. Ashley.
Hopkinton	Theo. Marks
Independence	E. F. Wulfke.
Indianola	Prof. J. L. Tilton.
Iowa City	Prof. A. L. Arner.
Iowa Falls	J. B. Parmelee.
Jefferson	Dr. Chas. Enfield.
Keokuk	*Fred. Z. Gosewisch.
Keosauqua	Prof. J. H. Landes.
Larrabee	H. B. Strever.
La Crosse, Wis	*W. U. Simons.
Logan	Mrs. M. B. Stern.
Mason City	Edw. E. Wilcox.
Manson	W. L. Thompson.
Marshalltown	L. S. Kilborn.
Maquoketa	Dr. A. B. Bowen.
Mechanicsville	Rev. J. W. Hubbard.
McCausland	Miss Ruby Pearl Barr.
Milton	Hon. E. C. Holland.
Mooar	F. G. Thomas
Monticello	Henry D. Smith
Mount Vernon	Prof. A. Collin.
Murray	A. W. Lewis.
Muscatine	J. P. Walton
Newton	A. Lufkin.
Omaha, Neb	S. S. Bassler.
Osage	G. D. Pattingill
Oskaloosa	Jos. Boyd.
Panama	Wm. J. Wicks.
Postville	F. L. Williams.
Richland	Wm. A. Shaffer.
Sanborn	T. D. White.
Seymour	Mrs. C. A. Conger.
Sibley	G. W. Baxter.
Sidney	G V. Swearingen.
Sioux City	*U. G. Pursell
Spirit Lake	R. B. Young.
Storm Lake	A. J. Bond.
Tipton	J. M. Rider.
Vinton	T. F. McCune.
Villisca	Hon. J. S. Boise
Washington	Wm. A. Cook.
Webster City	C. M. Trumbauer.
Winterset	Will McKnight.
West Bend	Phil. Dorweiler
Williams	M. L. Fuller.

*U. S. Weather Bureau.

WEATHER-CROP OBSERVERS.

Reporting for the Weekly Bulletin.

Afton	M. V. Ashby.
Agency	J. H. Van Zant.
Albia	Wm. Mercer.
Alta	Hon. H. T. Saberson.
Ames	Henry C. Wallace.
Anita	H. T. Chapin.
Ankeny	Ed. Parmenter.
Battle Creek	A. Preston.
Bloomfield	Geo. Duffield.
Boone	L. C. Morris.
Carbon	N. M. King.
Carson	G. N. Ferguson.
Centerville	Henry Galley.
Charles City	W. B. Towner.
Charlton	M. J. Burr.
Clarksville	F. M. Russell.
Clermont	Chas. Larrabee.
Council Bluffs	L. Prouty.
Dedham	J. W. Kay
Danville	Sherman Matthews
Emerson	D. B. Nims.
Ely	Hon. A. J. Fuhrmeister.
Fontanelle	W. H. Bridgman.
Ford	W. W. Whitmore.
Fort Dodge	R. W. Blaine.
Geneva	Wm. H. Thompson.
Grand River	Dr. John Daykin.
Grinnell	A. O. Price.
Hesper	G. E. Dillingham.
Hodge	James Piper.
Humboldt	G. L. Tremain.
Hamlin	F. P. Moore.
Humeston	S. H. Moore.
Independence	C. L. Thomas.
Indianola	T. B. Hammer.
Jefferson	S. M. Taylor.
Larrabee	H. H. Carnahan.
LeMars	Hon. Henry Schrooten.
Ledyard	Frank Miller.
Lawler	Hon. Wm. Glattly.
Lockridge	John F. Farman.
Manning	H. W. Pollock.
Mapleton	A. Lamb.
Marshalltown	Hon. J. G. Brown.
Mason City	Wm. Nettleton.
Mt. Ayr	Hon. Wm. Shriver.
Mt. Pleasant	W. S. Wright.
Minburn	J. W. O'Brien.
Mount Vernon	Robert Smith.
Newton	J. P. Beatty
North English	J. L. Williams.
Nevada	O. G. Ashford.
Osage	E. W. Stacy.
Orange City	H. J. VandeWaa.
Paton	Hon. Joshua Jester.
Pittsburg	G. C. Duffield.
Polo Station	A. E. Miller.
Prescott	G. W. Iden
Paullina	Geo. Hakeman.
Rockwell City	J. G. Palmer.
Rock Rapids	D. E. F. Merrill.
Rossville	F. B. Wiley.
Sac City	Dr. C. Brown.
Sandusky	Z. Hollingsworth.
Sageville	Hon. F. N. Knoll.
Seymour	Mrs. C. A. Conger.
Shenandoah	Reuben Mullison.
Sioux Rapids	Will H. Hassing.
State Center	E. N. Thompson.
Sumner	John Dawson.
Tama	W. G. Malin.
Van Horn	Spencer Smith.
Wapello	O. P. Smith.
Waukee	John Wragg
Wheatland	D. Beckman.
Winterset	H A. Kinsman.
Wyoming	R. A. Norton.
Wall Lake	I. E. Wilcox
Yankee	W. S. Nicholson
Walnut	F. L. Martin
What Cheer	O. D. Lawrence

Met, 217.2

THIS NUMBER CONTAINS THE

June Crop Report.

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J. R. Sage,
Des Moines.

UNITED STATES DEPARTMENT OF AGRICULTURE
WEATHER BUREAU.

MONTHLY REVIEW

OF THE

Iowa Weather and Crop Service.

VOL. IV.—MAY, 1893.—NO. 5.

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CENTRAL STATION, DES MOINES, IOWA.

J. R. SAGE,
DIRECTOR.

GEO. M. CHAPPEL, M. D.,
LOCAL FORECAST OFFICIAL,
U. S. WEATHER BUREAU, ASS'T DIRECTOR.

DES MOINES:
G. H. RAGSDALE, STATE PRINTER.
1893.

THE IOWA WEATHER AND CROP SERVICE.

Was established by act of the Twenty-Third General Assembly, and placed under supervision of the Board of Directors of the State Agricultural Society, constituted as follows:

OFFICERS.

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U. S. Department of Agriculture---Weather Bureau.

MONTHLY REVIEW

OF THE

IOWA WEATHER AND CROP SERVICE.

VOL. IV.] MAY, 1893. [NO. 5.

IOWA CROP REPORT, JUNE, 1893.

ACREAGE AND AVERAGE CONDITION OF CROPS, CONDITION OF LIVE STOCK, ETC.

The crop season of 1893 opened under favorable conditions for plowing and seeding, and during the first half of April an unusual amount of farm work was done, with the soil in excellent tilth. The last half of April and first half of May were unusually cool and wet, retarding all farm operations in the larger part of the State. Since about the middle of May the season has been fairly good, and the time has been well improved. The June reports of the correspondents of this Bureau, relative to the acreage and condition of crops, live stock, etc., give the following results:

WINTER WHEAT—This crop is now raised in small areas in forty-four counties. The reports show an increase of 2⅓ per cent in the acreage, as compared with last year. The condition of the crop is rated at 87 per cent.

SPRING WHEAT—There is an average reduction of 6 per cent in the acreage of spring wheat, compared with 1892. Its condition is placed at 96 per cent. On the basis of the estimated acreage of last year, the total yield of spring and winter wheat in Iowa will not exceed 7,000,000 bushels.

CORN—The reports of correspondents show an increase in the acreage planted in corn in every county except two. The average increase for the State is 10 per cent, compared with last year. The total acreage is not yet officially estimated from the returns of township assessors, but it will probably not exceed 6,500,000 acres. The condition of the crop is 98 per cent, the stand and color being generally very good.

OATS—Seventy-eight counties report an increase in the acreage of oats, and twenty-one report a decrease, compared with last year. The average for the State gives an increase of 5 per cent in the area sown, and the average condition is 96 per cent

RYE—Decrease in acreage, 7 per cent; condition, 93 per cent.

BARLEY—Increase, 1 per cent; condition, 95 per cent. This cereal is raised in about three-fourths of the counties of the State, and the total acreage is small.

FLAX—There appears to be an average decrease of 12 per cent in the area of this crop, compared with 1892. The condition is 94 per cent.

TIMOTHY—An increase of 1½ per cent is reported in acreage; condition 98 per cent.

CLOVER—The reports show a decrease of ½ per cent in the area sown in clover this season. The condition is 95 per cent. Clover meadows were generally killed out or injured by the severe winter, which will materially reduce the crop of clover seed this year.

MILLET—A decrease of 2 per cent in the acreage of this crop is reported. Condition, 96 per cent.

BROOM CORN—This crop is raised in small quantities in about one-fourth of the State. Reports show a decrease of 5 per cent in the acreage planted. Condition 91 per cent.

SORGHUM—Decrease, 3 per cent; condition, 93 per cent.

IRISH POTATOES—Increased acreage 5½ per cent, compared with last year. Condition of crop, 101 per cent.

SWEET POTATOES—Acreage same as last year; condition, 95 per cent.

PASTURES—99 per cent and meadows 98 per cent. The hay crop will be heavy.

SPRING PIG CROP—Reports from nearly every county show a heavy loss of spring pigs from effects of cool weather and other causes. The average is 72 per cent, or a loss of 28 per cent of the crop.

LIVE STOCK CONDITION—Cattle, 97; sheep, 97; hogs, 95; horses, 100; foals, 88.

Condition of soil compared with 1892, 129 per cent.

The latest frost reported was June 1, but it was not damaging.

The majority of correspondents report the season from 8 to 10 days early compared with last year.

TABLE SHOWING INCREASE OR DECREASE IN CROPS.

COUNTIES.	WINTER WHEAT.		SPRING WHEAT.		CORN.		OATS.		RYE.		BARLEY.		FLAX.		TIMOTHY.		CLOVER.		MILLET.		BROOM CORN.		SORGHUM.		IRISH POTATOES.		SWEET POTATOES.	
	Increase.	Decrease.	Increase.	Decrease.	Increase.	Decrease.	Increase.	Decrease.	Increase.	Decrease.	Increase.	Decrease.	Increase.	Decrease.	Increase.	Decrease.	Increase.	Decrease.	Increase.	Decrease.	Increase.	Decrease.	Increase.	Decrease.	Increase.	Decrease.	Increase.	Decrease.
Adair	3	....	....	6¾	7¾	....	....	⅝	....	7	....	10	....	17½	....	....	1½	6	....	11	....	10	....	8	6¾	....	....	....
Adams	7	....	....	3½	8½	....	¾	....	....	10	....	10	....	10	¾	....	....	4¼	....	30	....	10	....	15	....	3	....	....
Allamakee	5	....	....	30	5	....	....	2½	5	....	10	....	....	30	2½	....	....	....	5	....	....	....	....	10	6¼	....	....	....
Appanoose	....	4¼	....	10	9¾	....	20	....	....	11¼	....	....	....	3½	2	....	....	2	7	....	....	10	6¼	....	8½	....	12½	....
Audubon	0	....	....	2½	3	..	2⅜	....	....	8½	....	7	....	20	5	....	8	0	....	25	0	....	13½	....	9	....	....	....
Benton	....	15	....	11¼	10¾	..	3	....	7	....	4	..	....	27½	6	....	10	....	....	10	....	....	....	6½	7½	....	....	10
Black Hawk	....	....	....	0	....	....	....	½	....	2	5	....	....	7½	....	3	....	2⅛	....	20	....	....	....	10	5	....	10	....
Boone	....	10	....	5	9⅜	....	2	....	....	3	....	5	....	16	5½	....	4	....	2½	....	....	5	....	14½	5	....	....	9
Bremer	....	....	....	5	3	....	....	1¾	0	....	....	....	....	7⅜	1⅜	....	½	....	....	....	....	....	0	....	....	5	....	....
Buchanan	....	....	....	25	8	....	5	....	....	12½	....	....	....	40	1	....	2	....	....	....	....	....	....	22½	....	10	....	....
Buena Vista	....	....	....	20	19	....	4¼	....	....	40	....	4	....	15½	4	....	1⅜	....	....	10	....	....	....	....	4	....	....	....
Butler	....	....	....	3	8½	....	....	6⅝	....	5	4	....	7	....	3	....	....	1	....	2½	....	....	0	....	7⅜	....	....	....
Calhoun	....	....	3½	....	13	....	4⅜	....	....	2½	5	....	6	11	....	....	5	....	....	20	0	....	2½	....	5¼	....	....	....
Carroll	1⅜	....	2	....	10	....	5	....	....	10	....	8⅜	..	21½	2½	....	3	....	....	20	....	....	....	3½	7	....	....	10
Cass	14	....	....	12¼	11¼	....	....	1⅛	....	10	....	....	....	....	3¾	....	6¼	....	....	7½	5	....	....	20	¾	....	....	....
Cedar	....	12½	....	10	7	....	1¼	....	⅝	....	8½	....	0	....	2	....	4½	....	....	....	....	12½	25	....	5	....	25	....
Cerro Gordo	30	....	....	4	....	3½	....	4¼	....	6¼	10½	....	....	5½	....	⅝	1½	....	....	10	....	....	....	....	5	....	....	....
Cherokee	1	....	....	5¾	9	0	....	....	5½	....	6¼	....	....	22½	7½	....	2½	....	5	....	....	....	....	....	11¾	....	....	....
Chickasaw	....	5	0	....	9	....	....	4	....	....	7	....	....	4	....	½	1⅜	....	10	....	....	....	....	7½	5½	....	....	....
Clarke	4	....	....	16⅝	7½	....	5	....	....	2½	....	10	....	20	2	....	....	2	....	5	5	....	....	1	11	....	1⅜	....
Clay	....	10	....	2½	21¼	....	18¼	....	2⅜	....	2½	....	....	16⅜	13	....	7	....	....	7½	....	....	....	....	5	....	....	....
Clayton	....	10	....	....	13½	....	8½	....	....	3½	0	....	....	....	13¼	....	3½	....	....	....	....	....	15	....	8½	....	....	....
Clinton	....	20	....	10	8⅜	....	3½	..	10	....	10	....	....	....	1⅜	....	....	1⅜	....	....	....	....	....	....	2½	....	....	....
Crawford	12½	..	2½	....	12½	....	1⅜	....	....	6⅜	....	6	....	15	....	½	16	....	....	16¼	....	20	....	17	....	4	0	....
Dallas	7¼	....	....	7¼	10⅜	..	¾	....	....	4	....	....	....	....	3	....	4	....	....	4¾	....	....	....	3½	6½	....	3	....
Davis	....	7	....	....	17	....	10	....	....	7½	....	....	....	....	1⅜	½	....	0	....	....	....	....	7½	....	2½	....	0	....
Decatur	11¾	....	....	1⅜	13⅜	....	10⅜	....	....	5	....	....	....	20	....	½	....	4	....	25	....	10	7½	....	11½	....	0	....
Delaware	....	21¼	....	14	10	....	8¾	....	....	8½	2	....	....	....	2½	....	....	1¼	....	5	....	....	....	10	5	....	....	20
Des Moines	0	....	5	....	20	....	5	....	....	50	10	....	....	20	....	10	....	15	10	....	....	....	10	....	11¾	....	....	7½
Dickinson	2	....	10⅜	....	12½	....	⅛	....	....	12½	12¼	....	....	1⅜	12½	....	5	....	....	8½	....	....	....	....	6¾	....	....	....
Dubuque	....	4¾	....	3	12⅜	....	8	....	....	15	....	11¾	....	....	1	....	....	2	....	....	....	20	....	25	3	....	....	....
Emmet	....	....	0	....	14	....	6	....	10	....	....	7	....	5	10	....	....	....	....	5	....	....	0	....	4	....	....	....
Fayette	2½	....	....	35	6½	....	....	⅝	....	9½	....	1¼	....	11	3	....	6	2	3½	....	0	....	....	14	....	3½	....	10
Floyd	7½	....	3	....	....	1	....	5	....	1	12	....	....	8	4½	....	3	....	13½	....	....	....	....	5	10½	....	....	....
Franklin	....	....	....	2	5	....	⅛	....	....	7	0	....	....	18½	4⅜	....	....	½	25	....	....	....	....	....	6	....	....	....
Fremont	5	....	....	15	8	....	4	....	....	10	....	20	....	....	3	....	....	½	8½	....	....	....	....	20	....	⅛	7	....
Greene	5	....	....	2½	¼	....	2	....	....	2½	7½	....	....	11½	3½	....	7⅜	....	10	....	40	....	....	8½	9	....	....	10
Grundy	....	....	....	6¼	6½	....	....	½	....	3½	....	2	....	13⅜	....	1¼	....	4½	....	2½	....	....	....	10	4¼	....	....	....
Guthrie	19	....	2¾	....	7¼	....	....	¼	....	7½	....	2½	....	5	4¾	....	6	....	7¾	....	10	....	....	7½	8	....	....	7
Hamilton	....	....	....	16¾	7½	....	....	9¼	....	20	....	2½	0	....	5¼	....	3	....	0	....	....	....	....	....	4¾	....	....	12½
Hancock	....	....	....	14	9	....	3	....	....	....	2½	....	....	28	4	....	¾	....	....	3½	....	....	....	....	1⅜	....	....	....
Hardin	....	1⅜	....	1¼	5¼	....	1	....	....	7½	1⅜	....	....	19	....	⅜	....	4¾	....	....	2½	....	3½	....	6	....	⅓	....
Harrison	....	5	....	10	7	....	5	....	....	3½	5	....	0	....	1	....	10	....	1⅜	....	....	....	....	....	7	....	30	....
Henry	....	11	....	....	13	....	8	....	....	33¾	....	....	....	....	17	....	....	60	....	....	....	....	....	....	18¾	18	....	10
Howard	3¾	....	....	¾	7⅜	....	3½	....	3½	....	9¼	....	....	14½	4	....	....	1½	....	5	....	....	....	25	8⅜	....	....	....
Humboldt	16⅜	....	....	15⅜	10	....	1	....	....	1¾	2	....	....	8½	4½	....	4½	....	....	....	....	....	....	10	....	⅜	....	....
Ida	30	....	....	12½	11	....	1	....	....	17½	....	16	....	10	3	....	13	....	....	17½	....	....	....	....	0	....	....	30
Iowa	....	37½	....	10	10	....	....	13¾	....	32½	....	....	....	....	....	5	....	11¾	....	....	....	....	....	2½	12½	....	....	....
Jackson	....	2	....	5	11	....	....	⅜	....	5	0	....	....	....	....	2½	2½	....	....	....	....	....	....	....	8½	....	0	....
Jasper	8⅜	....	....	9½	6½	....	⅛	....	....	8¾	0	....	0	....	⅛	....	....	3	....	5	0	....	....	3	0	....	....	1⅜
Jefferson	....	15¾	....	25	8	....	16	....	....	17	8½	....	....	....	4	....	....	16⅜	5	....	10	....	....	¾	5	....	⅜	....
Johnson	....	9	....	15	17	....	9¼	....	....	9	....	....	....	....	....	1½	....	7	2½	....	10	....	8½	....	12¼	....	15	....
Jones	....	10	....	10	9	....	....	1	....	10	27½	....	....	....	....	1⅜	....	1⅜	....	50	....	50	....	3½	6⅜	....	....	....
Kossuth	....	....	10	....	20	....	....	10	....	0	....	20	....	0	....	5	....	0	....	....	....	....	....	....	10	....	....	....
Keokuk	2	....	2	....	26⅜	....	25	....	....	4½	....	....	....	6⅜	....	7	....	17	....	....	....	....	....	1	9½	....	....	2½
Lee	....	20¾	....	....	16	....	9	....	....	13¾	....	....	....	....	11⅜	....	19½	....	5	0	....	....	10	....	7	....	5	....
Linn	2½	....	1⅜	10⅜	....	3½	....	....	4½	....	....	....	0	....	....	10	....	....	....	....	1¼	....	....	10⅜	....	10	....	....
Louisa	....	10	10	....	15	....	12½	....	....	50	....	....	....	....	5	....	5	....	....	....	10	....	....	10	....	10	....	....
Lucas	9	....	....	10	12	....	5	....	....	5	15	....	....	5	....	6	2	5	....	2½	....	....	1⅜	9⅜	....	2½	....	....
Lyon	....	....	....	3½	11⅜	....	0	....	....	10	12½	....	....	17½	9	....	8½	....	15½	....	....	....	....	4½	....	....	....	....
Madison	13	....	....	6⅜	13⅜	....	1½	....	....	9½	....	....	10	....	½	....	3½	....	2½	....	....	....	5	....	5½	....	2⅜	....
Mahaska	....	2	....	20	10½	....	0	....	....	24⅜	....	....	....	....	....	4	....	33½	....	....	....	....	....	....	8½	....	....	50
Marion	....	5	....	8½	12½	....	3½	....	....	6	....	10	....	....	....	7	....	5½	5	....	15	....	....	4	6½	....	....	1¼
Marshall	....	25	0	....	6⅜	....	....	2	5	....	15	....	5	....	4¼	....	0	....	....	....	....	....	....	10	¾	....	10	....
Mills	7	....	....	9½	5¼	....	3½	....	....	16⅜	....	10	....	40	1⅜	....	....	⅜	7	....	....	....	....	....	....	7½	....	15
Mitchell	20	....	....	7½	7	....	....	6	5	....	4	....	....	8½	1	....	....	4½	6	....	10	....	3½	1	....	....	....	....
Monona	25	....	....	15	2½	....	15	....	....	2½	....	....	....	....	12½	....	12½	....	2½	....	....	....	....	5	....	....	....	....
Monroe	4	....	....	10	9	....	6⅜	....	....	11¼	....	....	....	....	....	5½	1⅜	....	5	....	10	....	3	6	....	....	7	....
Montgomery	4¼	....	....	4	6¼	....	....	1½	....	19	....	....	....	....	2	....	2	....	0	....	....	....	....	2	....	0	....	....
Muscatine	....	3¼	0	....	6⅜	....	3	....	....	11	2½	....	....	....	2½	....	2	....	7⅜	....	....	....	15	....	....	½	....	7½
O'Brien	....	....	....	15	15	....	12½	....	5	....	15	....	....	12½	....	2½	0	7½	....	....	....	....	....	....	2½	....	....	....
Osceola	....	....	....	6	17½	....	1⅜	....	....	2	4	....	....	22½	1⅜	....	1⅜	....	32½	....	....	....	....	....	....	1	....	....
Page	1⅜	....	....	3½	6⅜	....	5	....	....	2½	....	....	....	....	....	1⅜	1⅜	....	10	....	26	....	....	3½	....	5	....	....
Palo Alto	....	....	....	8½	12	....	9	....	....	28	....	17	....	15	8½	....	1⅜	....	24	....	....	....	25	6⅜	....	....	....	....
Plymouth	....	....	....	5	4	....	1⅜	....	....	5	....	5	....	2½	13½	....	10	....	10	....	....	....	5	....	1⅜	....	....	....
Pocahontas	....	....	7¾	....	16¾	....	2	....	0	....	1⅜	....	....	8	13½	....	6	....	....	19¼	....	....	1⅜	10½	....	35	....
Polk	5	....	....	1½	12½	....	2½	....	....	7	....	12½	....	7½	5⅜	....	4	....	....	8½	....	....	8	0	....	2½	....	....
Pottawattamie	39	....	....	4	5	....	....	⅓	....	2½	....	16	....	....	⅓	....	4	....	0	....	....	....	8½	⅓	....	15	....	....
Poweshiek	10	....	....	2½	12	....	2	....	....	....	....	....	....	....	....	8½	....	10	....	....	....	....	2½	3	....	....	20	....
Ringgold	5	....	10	....	13¾	....	5¾	....	....	9	....	....	....	....	....	2½	2	....	9½	....	13½	....	6⅜	....	11¾	....	6	....
Sac	16¼	....	4½	....	9	....	3	....	1⅜	....	1	....	....	14	6½	....	11	....	4	....	....	....	2½	....	5½	....	....	....
Scott	2	....	....	7	11	....	6	....	....	4	....	14½	....	20	3	....	2	....	....	6¼	....	....	....	5	5½	....	10	....
Shelby	12	....	....	5	7	....	3	....	....	23	....	18	....	50	....	1	8	....	....	2½	....	....	....	12	0	....	4½	....
Sioux	25	....	....	8½	5¾	....	....	½	....	3½	10	....	....	30½	9½	....	5½	....	2½	....	....	....	....	2	3½	....	....	....
Story	....	....	0	....	6	....	3¼	....	....	3⅜	....	10	....	9	¼	....	6	....	10⅜	0	....	....	....	6	3	....	2½	....
Tama	10	....	....	3½	10	....	3	....	....	25	19	....	....	12½	4	....	0	....	25	....	....	....	....	....	2	....	....	....
Taylor	11½	....	....	25	12¼	....	8½	....	....	9	....	45	....	25	....	1¾	....	2¼	7½	....	5	....	....	8½	4	....	....	6⅜
Union	5	....	....	3¾	11½	....	2	....	....	5	....	....	....	3½	0	....	2	....	11½	....	10	....	....	¾	9½	....	....	1⅜
Van Buren	....	2	....	17½	15½	....	22	....	....	3	....	....	....	....	....	8	....	20½	3½	....	....	....	2½	11½	....	5	....	....
Wapello	....	10¾	....	....	13½	....	14¼	....	....	10	....	....	....	....	....	3¼	....	7	....	40	....	....	....	6⅜	....	1½	0	....
Warren	....	8½	....	18¾	14	....	9	....	....	9½	....	....	....	....	2	....	....	4⅜	10	....	....	5	....	1	6½	....	....	3
Washington	....	19¼	....	7½	13	....	4¾	....	....	12	....	5	....	10	0	....	....	6½	....	1	....	3	18	....	8½	....	5	....
Wayne	....	....	....	10	18	....	21	....	14½	....	....	....	6½	....	2¼	....	....	....	....	½	5	....	....	11	4¾	....	....	5
Webster	10	....	....	2½	5	....	3¾	....	0	....	....	3½	....	10	0	....	....	2½	2½	....	....	....	....	....	8¾	....	0	....
Winnebago	....	....	....	22¼	22½	....	5	....	....	....	15	....	....	10	0	....	....	12½	....	....	....	....	....	....	5	....	....	....
Winneshiek	....	7	....	7½	11¾	....	2¼	....	....	8½	9	....	....	8	1¾	....	....	1¾	....	....	....	....	13½	....	7¼	....	....	....
Woodbury	....	2½	....	1¼	5	....	1⅜	....	5	....	5	....	....	6¼	3½	....	....	1⅜	3	....	....	....	....	....	6⅜	....	....	....
Worth	....	....	....	8½	0	....	....	13½	....	....	6⅜	....	9	....	6⅜	....	....	....	16⅜	10	....	....	....	....	0	....	....	....
Wright	....	....	....	5	9	....	....	3⅜	....	12½	....	10	....	15	5	....	....	1	....	1¼	....	....	....	10	....	½	0	....
Average per cent	2½	....	....	6	10	....	5	....	....	7	1	....	....	12	1½	....	....	⅛	....	2	....	5	....	3	5½	....	0	....

TABLE SHOWING AVERAGE CONDITION OF CROPS AND STOCK.

COUNTY.	Winter wheat, per cent.	Spring wheat, per cent.	Corn, per cent.	Oats, per cent.	Rye, per cent.	Barley, per cent.	Flax, per cent.	Timothy, per cent.	Clover, per cent.	Millet, per cent.	Broom corn, per cent.	Sorghum, per cent.	Irish potatoes, per cent.	Sweet potatoes, per cent.	Condition of pastures, per cent.	Condition of meadows, per cent.	Cattle, per cent.	Sheep, per cent.	Hogs, per cent.	Spring pig crop, per cent.	Horses, per cent.	Foals, per cent.	Condition of soil compared with season of 1892, per cent.	Date last frost.
Adair	100	104	106	100	91	70	....	98	99	100	....	104	108	97	97	99	102	103	93	68	99	90	119	May 27
Adams	98	100	98	101	100	100	90	100	100	75	60	77	99	....	102	103	99	101	98	57	99	85	112	May 27
Allamakee	102	92	100	95	99	99	80	100	101	....	....	110	94	....	102	98	97	101	101	66	94	87	109	May 26
Appanoose	90	92	107	114	88	....	92	106	103	100	100	99	106	88	109	108	103	100	98	82	105	86	122	May 26
Audubon	....	94	85	93	77	95	75	96	96	95	..	92	98	....	95	97	89	95	88	67	91	97	123	May 26
Benton	92	102	99	101	98	106	90	101	103	100	....	100	104	....	97	105	101	101	97	75	98	97	121	May 25
Black Hawk	....	100	96	101	77	87	100	107	94	100	....	37	95	100	104	109	92	90	97	72	92	94	115	May 27
Boone	110	98	96	97	99	....	98	103	102	99	100	89	99	88	103	103	93	99	97	76	99	95	107	May 27
Bremer	....	95	95	83	84	..	100	101	101	95	100	100	87	....	99	101	97	99	96	67	94	92	107	May 27
Buchanan	....	85	98	99	88	....	90	94	107	100	90	100	100	105	110	94	89	101	81	60	96	100	131	May 27
Buena Vista	....	100	110	99	75	102	100	89	92	100	....	110	102	....	98	98	106	100	106	95	104	96	146	May 27
Butler	....	100	104	93	86	99	103	103	99	90	....	100	101	....	105	106	99	100	98	70	96	98	106	MOy 28
Calhoun	....	101	114	99	100	99	101	105	102	100	....	100	103	100	100	101	106	100	100	89	119	95	124	May 29
Carroll	103	103	105	98	95	95	91	100	104	99	100	96	100	100	100	101	96	101	99	78	98	94	116	May 27
Cass	84	92	95	91	100	....	....	95	100	....	....	70	100	....	96	97	95	100	100	78	102	87	110	May 26
Cedar	82	85	101	101	91	95	100	97	98	....	....	97	97	90	91	96	92	97	95	76	99	79	114	May 15
Cerro Gordo	100	86	95	90	85	89	88	99	92	87	....	....	92	....	107	107	91	75	92	78	96	100	108	May 28
Cherokee	75	92	102	85	75	104	75	92	90	100	....	....	102	....	93	85	102	100	100	70	100	94	93	May 27
Chickasaw	100	100	91	87	100	92	95	104	99	100	....	97	101	....	107	108	100	97	98	81	98	91	107	May 28
Clarke	89	100	97	104	101	105	100	100	99	100	95	96	103	102	102	100	96	97	96	83	99	94	119	May 27
Clay	....	94	100	92	87	107	83	100	100	72	80	80	97	100	97	97	100	97	96	74	99	83	107	May 29
Clayton	95	....	100	97	90	90	....	100	98	....	....	100	95	....	102	102	98	97	88	68	92	72	102	May 29
Clinton	100	110	108	107	100	105	....	103	99	....	....	..	105	....	107	103	102	100	102	90	100	98	111	May 29
Crawford	92	102	99	100	100	104	100	101	107	100	....	90	98	100	101	99	102	100	112	80	91	87	115	May 27
Dallas	87	91	98	86	106	100	90	100	101	90	....	88	99	99	101	97	100	102	93	68	93	91	117	May 27
Davis	74	....	106	127	93	....	....	107	99	100	100	95	119	98	103	103	99	98	99	72	100	84	127	May 6
Decatur	95	102	102	108	100	....	95	98	90	94	85	98	107	94	100	96	98	101	99	77	100	73	121	June 1
Delaware	83	98	97	101	84	98	....	101	100	..	....	97	100	95	100	101	97	99	100	88	96	92	131	May 28
Des Moines	50	50	98	107	87	....	....	80	82	....	110	100	98	90	95	97	97	103	97	70	97	82	110	May 27
Dickinson	....	105	110	100	95	100	100	105	100	100	..	....	107	....	116	119	102	103	102	102	110	85	117	May 29
Dubuque	92	83	89	83	89	84	....	90	99	....	85	75	97	....	86	84	83	99	86	53	92	91	84	May 23
Emmet	100	97	102	91	88	100	100	105	105	100	100	100	105	100	100	99	104	101	98	83	98	93	121	May 25
Fayette	88	85	104	96	91	90	95	87	102	100	....	94	96	100	104	103	96	87	99	68	100	91	114	May 21
Floyd	72	94	91	79	91	94	89	101	94	120	....	90	76	....	101	92	98	97	98	75	95	90	90	May 28
Franklin	....	97	95	89	95	97	96	101	102	100	....	....	92	....	106	106	97	97	93	72	101	99	107	May 28
Fremont	71	77	90	92	75	40	....	82	83	100	....	50	92	87	88	87	96	100	100	86	98	94	108	May 2
Greene	102	84	85	88	89	70	100	89	99	100	....	125	97	....	101	101	94	92	94	64	96	91	115	May 26
Grundy	100	99	103	92	100	102	100	104	103	100	....	95	99	100	102	105	98	101	97	66	102	89	121	May 28
Guthrie	95	89	97	95	100	100	100	96	96	98	....	100	103	96	97	97	101	102	96	80	97	97	115	May 27
Hamilton	....	84	101	86	90	93	95	101	103	93	....	100	100	82	102	104	95	102	91	70	98	88	107	May 28
Hancock	....	95	96	84	105	97	99	99	103	100	....	100	95	..	100	102	98	101	98	72	102	88	109	May 27
Hardin	97	98	96	96	105	90	80	101	100	90	105	94	100	85	102	101	98	98	92	80	97	92	104	May 28
Harrison	87	88	97	92	95	95	....	85	80	95	..	....	101	75	93	99	98	100	100	73	94	71	114	May 27
Henry	90	100	104	108	93	....	....	92	66	....	....	94	110	100	100	85	101	102	102	65	99	88	134	May 23
Howard	107	96	94	89	93	97	94	104	106	90	....	100	94	....	99	107	99	96	102	73	95	86	103	May 28
Humboldt	97	100	99	86	97	101	100	99	101	....	....	87	100	....	96	93	101	99	93	76	99	86	124	May 26
Ida	55	103	109	102	88	102	102	112	105	55	....	....	89	105	85	110	104	77	106	85	99	85	118	May 26
Iowa	102	105	111	101	102	....	....	99	87	....	....	100	117	....	87	95	90	99	97	69	95	90	131	May 26
Jackson	101	115	101	106	103	100	....	99	103	....	....	100	101	100	95	95	99	100	100	88	101	96	130	May 17
Jasper	91	94	96	96	90	100	....	96	92	95	87	89	98	86	98	97	99	99	97	65	97	86	112	May 27
Jefferson	63	91	91	111	81	103	....	95	80	100	90	80	100	94	97	92	93	98	99	71	96	92	124	May 18
Johnston	99	85	103	101	97	....	....	94	84	110	80	83	109	90	100	93	97	103	91	68	101	94	120	May 23
Jones	70	97	105	102	94	102	....	80	100	....	....	93	101	..	101	96	98	101	97	78	97	96	139	May 10
Kossuth	....	110	115	90	....	100	110	100	105	100	....	....	110	....	110	110	110	100	90	80	110	100	130	May 22
Keokuk	105	151	133	121	96	....	....	79	89	....	....	98	114	98	97	94	102	98	98	69	102	87	152	May 9
Lee	72	....	113	111	83	....	....	76	53	100	95	107	113	109	86	77	91	96	87	83	94	94	122	May 24
Linn	97	110	103	103	92	....	....	98	90	....	....	107	101	....	96	96	92	85	92	69	96	97	128	May 20
Louisa	100	....	90	100	100	....	....	100	100	....	....	....	100	....	100	100	90	100	80	70	100	87	110	.....
Lucas	96	100	96	102	99	102	100	102	102	103	95	90	101	96	103	103	99	99	99	79	97	89	115	May 16
Lyon	....	102	112	101	90	106	90	102	87	100	....	....	100	..	92	101	102	101	98	64	100	97	120	May 28
Madison	95	93	102	96	97	....	....	100	95	100	80	95	104	101	100	100	100	100	97	71	100	93	120	May 27
Mahaska	97	94	98	100	91	....	....	93	84	....	....	110	106	110	91	94	97	100	91	64	96	94	117	May 15
Marion	90	93	102	93	91	100	100	97	99	85	80	98	100	95	99	99	95	95	96	72	97	94	108	May 16
Marshall	98	96	91	99	95	100	95	105	95	..	75	87	107	100	90	107	102	101	83	64	101	94	109	May 23
Mills	101	97	103	98	90	90	....	96	95	95	....	100	97	86	91	89	99	100	93	75	101	101	117	May 25
Mitchell	105	97	90	92	94	94	87	102	103	95	100	90	95	....	101	102	98	98	97	75	96	95	96	May 28
Monona	90	87	100	100	90	....	....	95	82	90	....	....	92	80	87	97	97	100	87	70	100	90	115	May 26
Monroe	95	100	100	102	99	....	....	102	94	..	90	100	101	92	106	104	99	99	101	83	103	89	139	May 15
Montgomery	88	95	107	91	89	....	....	95	94	90	....	107	99	....	100	100	96	97	96	84	101	93	115	May 28
Muscatine	78	90	91	99	90	97	....	100	94	95	....	97	92	100	101	101	98	96	95	74	98	91	111	May 27
O'Brien	....	105	105	100	110	90	102	100	100	100	....	....	105	....	105	107	102	105	100	102	105	95	112	May 27
Osceola	....	108	122	109	83	115	100	102	102	98	....	....	108	....	101	101	102	100	102	87	99	99	129	May 27
Page	82	98	93	95	95	....	....	100	97	115	80	....	100	90	100	110	112	107	92	77	97	95	140	May 23
Palo Alto	....	93	106	90	95	100	100	95	100	100	....	100	100	....	95	100	105	103	101	76	101	99	114	May 27
Plymouth	....	98	98	98	85	100	100	93	92	100	....	....	112	....	88	92	99	100	102	83	97	98	112	May 23
Pocahontas	....	104	121	105	103	103	101	107	98	100	....	105	100	100	110	110	107	103	103	86	101	81	150	May 26
Polk	99	96	98	94	91	90	92	102	93	9	100	93	99	92	99	100	93	99	96	77	96	89	114	May 29
Pottawattamie	84	96	88	97	91	90	....	98	90	98	....	92	91	100	95	98	94	100	92	56	94	89	107	May 27
Poweshiek	105	97	106	98	95	....	....	98	86	....	....	92	105	100	97	94	94	100	99	67	99	84	134	May 23
Ringgold	94	105	107	106	98	....	....	99	97	97	100	95	103	96	100	97	96	101	100	69	102	89	111	May 23
Sac	89	96	106	89	94	95	100	96	97	103	....	100	101	100	98	102	99	99	94	70	99	92	129	May 27
Scott	76	95	98	101	92	95	....	97	94	100	....	100	97	100	100	98	95	98	95	74	100	91	121	May 17
Shelby	69	104	93	107	98	101	....	98	88	100	....	100	97	87	96	101	95	98	100	77	99	94	114	May 27
Sioux	25	103	107	102	91	106	101	104	76	100	....	100	98	....	101	98	102	100	101	67	99	92	111	May 27
Story	....	98	99	97	93	90	98	106	106	100	85	93	103	94	106	108	96	97	93	65	98	90	111	May 21
Tama	100	101	102	109	82	107	90	107	94	94	....	61	98	85	100	107	95	98	95	65	98	92	113	May 7
Taylor	84	....	103	116	92	50	75	100	93	100	60	97	115	101	101	102	93	83	92	63	95	85	134	May 20
Union	87	91	92	93	78	....	92	98	101	100	....	99	99	103	98	100	101	103	95	66	102	96	135	May 28
Van Buren	78	85	104	112	94	....	....	91	62	100	....	99	116	99	98	87	93	93	100	68	94	87	115	May 16
Wapello	89	....	107	114	94	....	....	97	81	100	....	100	110	100	90	98	91	99	99	89	100	89	122	May 6
Warren	91	96	107	99	90	....	....	98	91	100	105	104	97	97	98	98	97	98	95	55	100	87	118	May 23
Washington	69	85	113	108	90	100	105	99	73	99	103	101	114	102	102	94	101	99	97	62	99	99	132	May 28
Wayne	86	75	97	102	89	....	92	100	95	80	78	87	118	101	99	100	98	97	97	60	97	61	131	May 17
Webster	90	97	106	99	105	104	100	100	105	100	....	100	102	....	100	95	104	100	96	84	100	99	107	May 17
Winnebago	....	105	100	105	....	105	100	105	110	....	....	..	100	....	100	109	95	100	90	82	100	100	110	.....
Winneshiek	102	100	95	97	95	102	96	101	101	100	....	90	101	100	99	102	93	98	89	65	99	79	103	May 29
Woodbury	90	105	103	104	95	100	95	102	92	100	....	....	101	....	103	107	99	....	92	67	99	89	122	May 27
Worth	....	87	85	80	....	93	92	88	98	80	....	....	87	....	100	103	97	92	85	73	85	80	83	May 23
Wright	....	95	100	82	83	89	96	103	104	94	....	81	96	100	102	105	100	95	92	72	96	96	107	May 22
Average per cent	87	96	98	96	93	95	94	98	95	96	91	93	101	95	99	98	97	97	95	72	100	88	129	June 1

WEATHER AND CROP NOTES.

In a letter addressed to the Director, Mr. J. H. Wheeler, of Rockwell, Iowa, writes: "While the climate of the earth has not appreciably changed in historic times we know it must be constantly changing. That the changes are slow we are aware; 3,000 years are but a moment of time. Six thousand years may be set down as the probable length of time which has elapsed since the beginning of Egyptian civilization and there is no good reason for believing that the climate in the Nile valley has changed since or probably for a long period before that time. On the other hand, Aryan tradition tells of a time of increasing cold which drove the people out of their first home. Again, there are those who hold that the glacial epoch closed in North America not longer ago than 6,000 years. It is even claimed that we are to-day in the closing period of the glacial epoch. It is said the glaciers of Alaska are still retreating."

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Wind is the great purifier, scattering and diffusing throughout space the poisonous exhalations from animal life, and the noxious gases of combustion and decaying matter. Stagnant air, like a sluggish stream, becomes foul and unfit to sustain animal life. The American cold wave is a continual purifier and the more we have of them the lower will be our mortality.—*Wisconsin Weather Journal.*

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The New York *Herald* points out the hygienic value of a snowstorm to a city of the north. It points out the fact that the snow-falls in New York during the first weeks in January brought down the death rate of the city from 29.63 to 23.20 for the week ending January 28th. This improvement was largely owing to a decrease in the ravages of the grip. The *Herald's* scientist attributes this decrease to the cleansing of the air from the floating dust particles brought down by snow.

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Again the bombardment of the heavens has been followed by copious rainfall. A press dispatch from Wichita, Kansas, dated May 26th, said: "By preconcerted arrangement between the mayors of the towns of Wellington, Winfield, Arkansas City, South Haven, Caldwell, Hutchinson and Newton, a simultaneous bombardment of the heavens began at noon yesterday. Cannon and every explosive within reach were brought into requisition, and hundreds of men and boys with guns blasted away at the skies till 2 p. m., when the clouds opened their reservoirs and drenched the earth, the rain continuing four hours. All the country for some miles beyond the radius of these towns was deluged by the heaviest rainfall in eight months. The crop prospects in the eight counties over which the rain fell are wonderfully improved."

They chose a favorable time for the experiment, as the U. S. weather maps will show. A "low" was hovering over the southwest, and all the indications favored copious showers, and the Weather Bureau predicted showers. The rains came, not only in the section where the bombardment was going on, but in all the region round about, and even at the westward. The whole of eastern Kansas was drenched. A portion of Nebraska received its share, and Missouri, Iowa and Illinois were abundantly supplied with moisture. At St. Louis 3.70 inches of water fell in twenty-four hours, and in Illinois there were tremendous down-pours, amounting to over 5.00 inches in some localities. Of course, in such a general and wide-spread precipitation in the southwest, Kansas received its share, and there is nothing to prove that the bombardment added a spoonful to its quota.

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A great wind storm, of wide extent and very destructive force, swept over Ireland and the west coast of England, January 6 and 7, 1839, and is still referred to by elderly people as the "big wind." Twenty persons were killed in Liverpool by falling buildings, and over one hundred were drowned in and around that city. In Ireland over two hundred houses were demolished, many of them being burned after being wrecked by the storm. It was a genuine hurricane.

***

Prof. J. L. Budd is of the opinion that bee-keeping and orcharding should go together. He says bees are the main agents in fertilizing fruit blossoms, and neighborhoods well stocked with bees have, one year with another better crops of orchard and small fruit than the ones wholly or nearly destitute of these busy workers.

***

If the chemicals and explosives caused the gentle rains in Kansas, it may be shown that they also brought down the heavy floods in other sections; and the people who have been damaged by excess will have a just cause of action in the courts, or may at least put a stop to the hoodoo operations by an injunction. But if the case should go into the courts, on complaint of damage by floods, it would be impossible to find a jury of intelligent men who would hold the so-called rain-makers responsible for the down-pour.

***

From various experiments respecting a connection between thunderstorms and the souring of milk, Prof. H. W. Conn draws the conclusion that electricity is not of itself capable of souring milk or even of materially hastening the process, nor can the ozone developed during the thunderstorm be looked upon as of any great importance. It seems probable that the connection between the thunderstorm and the souring of milk is one of a different character. Bacteria grow most rapidly in the warm, sultry conditions which usually precede a thunderstorm, and it will frequently happen that the thunderstorm and souring occur together, not because the thunder has hastened the souring, but rather because of the climatic conditions which have brought the storm have at the same time been such as to cause unusually rapid bacteria growth.

***

The Iowa editor who will awaken an interest in fruit growing among his farmer readers by his southern letters will fully compensate a loss occasioned by the emigration of five per cent of his people to that apparently more favored section. And the Iowa farmer who will expend upon his orchard one-tenth of the time and expense which the orange grower of Florida puts upon his little fruit farm will have a bonanza of which he never dreamed. The apple is the king of fruits, and if the people of Iowa will only swear allegiance to him there is new wealth and prosperity for them.—*Fairfield Ledger.*

THE LITTLE RAIN-MAKER.

"Scurious like!" said the tree-toad,
"I've twittered for rain all day;
And I got up soon
And hollered till noon,
But the sun hit blazed away
Till I just climbed down in a crawfish hole,
Weary at heart and sick at soul!

"Dozed away for an hour,
And I tackled the thing again;
And I sung and sung,
Till I knowed my lung
Was just about to give in;
And then, thinks I, if it don't rain now,
There's nothin' in singin' anyhow!

"Once in a while some farmer
Would come a-drivin' past,
And he'd hear my cry,
And stop and sigh.
Till I just laid back at last,
And hollered rain till I thought my th'oat
Would burst wide open at every note!

"But I fetched her! oh, I fetched her!
'Cause a little while ago,
As I kind o' set with one eye shet,
And a-singin' sof and low,
A voice drapped down on my fevered brain,
Sayin', 'If you'll just hush I'll rain!'"

—*James Whitcomb Riley.*

FORESTS AND CLIMATE.

[From the Iowa State Register.]

ROCKWELL, IOWA, May 10.—Ever since I can remember I have been reading and hearing about the disastrous climate effects of deforestation. This country has dried up and become a desert, and that country is drying up and becoming a desert. In the first deforestation is complete, and in the other it is going on at a rapid rate; therefore, deforestation converted one country into a desert, and is fast reducing the other to a like condition. Reasoning from the particular to the general it is easily concluded that actual deforestation would convert all countries into deserts, and partial deforestation would convert any country into a partial desert. At first this *post hoc, ergo propter hoc*, argument was sufficient for me, as it is still sufficient for many. But observations soon began to furnish exceptions to the rule, and as the exceptions kept on increasing in numbers, I finally began to doubt the soundness of the theory. I have finally concluded that deforestation by artifical or accidental means will not produce aridity, but that aridity will invariably produce deforestation. Forests do not materially increase the total precipitation of moisture, although, without doubt, their presence tends in some degree to a more general distribution throughout the year of the total humidity; that is, by conserving the precipitated moisture received and giving it off slowly the average humidity is more equally distributed throughout the year. Forests prevent denudation, and in some degree, drouths, but they do not appreciably affect the total precipitation of moisture. A forest may prove palliative in the case of increasing aridity, but not remedial. Forests themselves are but the effect of favorable conditions of soil and climate, and vanish with the disappearance of the conditions which created them.

Under the title, "The Penury of Russia," a writer in the Edinburgh *Review* asserts that the whole of eastern Russia has either already become a desert, or is fast becoming one, and describes the result to the deforestation of the affected region. In the first place, it is always unsafe to receive a bad report of Russia through English sources without making considerable allowance, not only for English prejudice, but for English motive in discounting all that is good about Russia, and magnifying all that is bad. The wish that some dire calamity might befall the great white czar and his dominions is with Englishmen too often the father to the thought.

According to this writer, the rivers of this portion of Russia are drying up, the average amount of rainfall is constantly decreasing, and the country is gradually becoming covered with sand. After making due allowance for exaggeration, I do not doubt the truth of what this writer asserts as to the conditions described. But when he says that "the cause lies in the devastation of the forests," I dissent. Why has not the devastation of forests in the Baltic provinces, Poland and the rest of western Russia produced like effects? Deforestation is much more thorough in the more thickly settled countries of Western Europe than in the sparsely settled regions of eastern Russia, yet we hear nothing of the encroaching desert. England has been stripped of her forests, yet there is no reason for the belief that the rainfall has either increased or diminished since Cæsar looked upon its endless woods. There is no reason for believing the "German woods" of the time of Tacitus received a greater precipitation than do the grainfields of modern Germany. At the time of its first settlement Iowa was practically a treeless plain; now its surface is literally covered with groves. Yet its average rainfall has neitner increased nor diminished since its first settlement. From fossil remains we know that our western plains were once humid in climate and covered with forests; they are now arid and treeless. These plains were not deforested by man, yet the forests have gone, never to appear unless the Rocky mountains sink. Under present climatic and physical conditions, man may by great and continued effort cover them with planted trees, but humidity will not come, aridity will continue. The average winds are dry and suck up instead of bringing moisture, The rainmakers will never bring rain from a dry sky. There are in the regions of the plains recurring series of wet and dry periods. These follow each other at more or less regular intervals. It should be noted that during the wet periods, when the atmosphere is sufficiently charged with moisture, the rain falls, though there are no forests. During the dry periods no amount of stunted trees could bring rain from an atmosphere capable of absorbing 70 per centum more moisture than it contains. Forests do not produce rains; it is rain that produces forests. England would be humid without a tree. The Sahara would be arid covered with trees.

It may be that wet and dry cycles recur in eastern Russia, and a dry cycle is now running its course. If so, the

misfortune of that region is only temporary. On the other hand it may be that the trans-Caspian desert is steadily and permanently advancing west and north. In that case no human effort can save the doomed region. In the latter case forests might prove alleviative but not remedial. The writer of the *Review* article gives what is probably the true cause of the increasing aridity and desert-like condition of eastern Russia when he speaks of "the fierce east desert winds, which, piercingly cold in winter and scorchingly hot in summer, wither the corn in a few days and bring with them sand storms which turn fertile fields into permanent deserts." These hot, dry winds, which bring with them the desert sands, contain no moisture, and, consequently, no amount of forest could make them produce rain. The deserts from which these dry, parching sandstorms come were once humid, well forested, fertile and populous, and were the home of the Aryan race. The causes which are drying up the Aral and Caspian seas have converted these once fertile countries into deserts and semi-deserts. Apparently these causes, which are still operative, as evidenced by the drying up of the Aral and Caspian seas, are extending the field of their operation still farther west and north. Why the Edinburg *Review* writer should ignore patent and adequate causes for the increasing aridity of eastern Russia, and assign a totally inadequate cause, seems singular. Yet just such inconsistent, unreasonable theorizing is going on all the time. Deforestation has no more to do with the growing aridity of eastern Russia, than it had to do with the making of the Sahara.

J. H. WHEELER.

WEATHER FORECASTING.

The following article on the theory and practice of "Weather Forecasting" was prepared by H. A. Hazen, Professor of Meteorology in the United States Weather Bureau, Washington, D. C., and is a most interesting and instructive article on weather indications throughout the United States:

INDICATIONS INSTRUCTIONS.

"It has seemed advisable to note a few of the more salient points and principles that have been established by the Signal Office in its work of forecasting the weather. It has been suggested that this work is done by intuition, and that it would be almost impossible for a good forecaster to impart his knowledge to another. This view needs a little explanation, I think. It means that long years of practice are needed to enable one, at a moment's glance, to grasp the more important points on a weather map, and to determine just what the indications are for the near future. It means that we cannot draw up a formula into which we can enter certain quantities and then solve the equation. While a forecaster learns by practice to read a map quickly, yet, I think, if called upon at any time to give a reason for a certain forecast, he would be able to explain his train of thought, though at the moment it may have come to him without a long study.

"My own experience in this work has been since September, 1887, only. I found that no general principles had been laid down, and that it was necessary for each one to work out his own principles by a study of the maps. It must be admitted that there was a certain advantage to be gained in this experience, for by it one does not get his information second-hand, or in a way which he would find it difficult to apply, but he learns the work little by little, and by repeated failures finds just what he is able to tell fairly well, and just where the doubtful points are. To my mind, however, there are certain fundamental ideas which can be written out quite easily, and which will be of great help to a beginner in this work.

AVERAGE CONDITIONS ONLY TO BE PREDICTED.

"First, we can hope to predict average conditions only. That is to say, taking five hundred maps in any month, the person who could go through those maps and make the best predictions, taking them as a whole, would be the most successful forecaster. Another person might do better on a hundred of the maps, but he could not take up a new map for that month and do as well as the first. The importance of this point may not at first be recognized. It is very essential to fix distinctly in mind that one must expect to forecast on an average condition only. If he finds a particular case in which he has failed, he must learn to feel that were a similar case to come up, or even the very same case, he would make exactly the same prediction. It seems to me the best goal to set before one in forecasting is to be able to make the same prediction, from the same map, over and over again, no matter how many months have intervened between the trials, and though each attempt should give not more than 70 per cent as a result, for I feel sure there are such maps. If a person finds he has failed in any particular case, and tries to apply that seemingly new principle on a subsequent, apparently similar map, he will again fail, because the original forecast depended upon an average condition and the second map was an average map.

"A good example of this principle has been recently called to my attention by Professor Carpmael, of Toronto, Canada. Several years ago one of his forecasters predicted a thaw on a map that had every appearance, as Professor Carpmael thought, of a hard freeze; but sure enough the thaw came. Two or three years afterward another forecaster in examining the old maps came across the above abnormal case; and it so happened just about that time he had a map exactly like the former, and because of the success in the former case he predicted a thaw. When Professor Carpmael saw the map he decided at once that there would be a very severe cold wave, and calling the attention of the forecaster to what the map seemed to indicate, he was shown the previous map on which the prediction of a thaw had been successful. In the second case, however, there was a very hard freeze, one of the worst of the whole winter. This would also seem to show that we cannot predict very satisfactorily upon the idea of types, but every map must be studied on its merits alone, without trying to find a previous one that looks almost exactly like it.

PERSISTENCY OF WEATHER CONDITIONS.

"Another principle to be borne in mind is that prevail-

ing conditions are, as a general thing, more likely to continue than to change. We have common proverbs which enforce this principle: 'All signs of rain fail in a dry time,' 'It will not stop raining until the moon changes,' etc. It will be repeatedly found that when clouds are breaking away after a long rain it is unwise to forecast clearing for at least twelve hours. This is especially true for the lake regions and the mountains of the east part of the country. One of the first rules that a forecaster learns is that he is likely to anticipate altogether too much rain, and that there is almost a remarkable persistency in fair weather conditions. Even after clouds come up in the southeast quadrant of a storm, unless rain has already begun falling to the westward, it is very dangerous to predict rain. This is especially the case if the high area in front of the storm has any tendency to the south or southeast.

FORECASTS CANNOT BE MADE ON GENERAL LAWS.

"The ordinary theory is that rain is generally caused by the condensation of moisture in an ascending current of warm, moist air. It is certain, however, that no use whatever can be made of this theory in forecasts. Rain certainly does not occur at the centers of our storms where we would naturally expect the strongest upward tendency. It does fall frequently in the southeast quadrant of storms, but even this rule cannot be followed in forecasting rain, for the reason that the distance from the center of the storm is very uncertain, and often there is no rain to the southeast. The only safe rule to follow is to locate, as near as possible, the position and extent of rain areas which have already begun, on successive maps. Oftentimes when scattered light rain has occurred in any region one feels very certain that rain is sure to occur at some points, but it is much safer not to try to predict the particular localities, but to leave out the rain prediction, for the reason that one is just as likely to put the 'rain' exactly where it does not occur, and the 'fair' just where it rains. This is especially the case west of the Mississippi river, and wherever there is not much rainfall.

NORTHERLY CURRENTS MEETING SOUTHERLY.

"There is a single partial exception to the rule that rain cannot be predicted on general principles, and this is when there is foreseen a marked movement of the air from both north and south areas toward each other. This occurs when a high area hovers over the Southern States, and a partial trough is formed with another high to the north. Under these conditions, which ordinarily might be anticipated to give the clearest weather, clouds will frequently arise and light rains will fall. Even here, however, great caution is needed, and it is generally safer not to try to forecast rain unless one has seen rain already falling. This is especially the case in the colder months of the year.

LOCI OF STORMS.

"It will be found that at certain times there is a remarkable persistency in the occurrence and beginning of storms in certain well-defined localities. One of the best marked of these is in west Texas, another is over Lake Michigan, still another over North Carolina. The latter often moves to the Middle Atlantic coast. In such cases, storms seem to hover around these loci. Oftentimes rain will emanate from a low area and spread over the whole country without any motion whatever of a low pressure area. Such rains are the most difficult of all to predict, and occur usually at a time when the upper movement of the whole atmosphere is very much diminished. In fact, it may be laid down as a general rule, that when there is a rapid movement of storms and high areas across the country, the weather and temperature are far easier to predict than when this movement slows down. In the former case storms are much more likely to clear up clean and not leave straggling showers; the temperature, especially, runs in much more marked contrasts, and its changes are far easier to forecast.

RAINFALL ON THE GULF COAST.

"Rain on the Gulf coast does not follow any rules at all, except that if it has begun seemingly in the center of a fair condition one cannot with safety predict anything but showers, and continue this prediction until the rain has ceased. This is especially true of Florida. A remarkable weather condition sometimes prevails on the Gulf, and this has not, as yet, been thoroughly studied. During times of prolonged drought in the Gulf States, it will be found that rain is often much more likely to occur in the interior than on the immediate coast. This is especially true in hot summer weather. On the immediate lake shore it is generally safe to predict showers on the approach of well-marked low areas, though even this is not an invariable rule.

SUREST CONDITIONS FOR FAIR WEATHER.

"There are certain remarkable conditions under which one is always safe to predict fair, even though the skies are very threatening and a strongly marked low area is advancing. These conditions are when a high area of great magnitude moves south or southeast from the northwest and is followed in the extreme northwest by a low area of seemingly great intensity. Often the barometric gradient becomes steep enough to give winds of forty and fifty miles per hour, and everything betokens a very severe storm. Nevertheless, no rain is likely to occur in front of the storm, and this condition will continue until the high area begins to give way, and the southerly wind dies down to almost a calm; after that rains may be expected, especially in the lake regions and on the Atlantic coast. This condition, however, must be carefully distinguished from another wind which at first sight seems analogous, but which gives entirely different results. This is when the high area in front of the storm takes an easterly trend, the winds from the latter are more easterly and cooler, and as a consequence rain immediately begins in the lake regions and persists for a long time, or until the storm has completely passed over, or the high area has finally taken a southerly tendency.

RAIN IN HIGH AREAS OR THE REAR OF STORMS.

"A rather remarkable accompaniment of these conditions just described is the occurrence of rain in the rear of the storm. This is one of the safer predictions to

make, although seemingly directly contrary to all the principles of forecasting, to which one becomes accustomed in the east. In the Atlantic States it is well known that while the storm is still to the westward, southerly winds spring up, bringing more or less rain, but after the low area has passed by, rather strong and very dry, cold west and northwest winds come in, and the sky clears almost immediately. On the contrary, in the west the warm southerly winds are very dry and no rain occurs in front of the storm, while the cold west winds bring on rain, which frequently persists even to the center of the high area. It seems probable that the proximity of the Atlantic Ocean in the former case and of the Pacific in the latter may account for these differences. The movement of the clouds in the rear of the western storm is from the Pacific, as may be seen readily on the cloud chart, and this indicates a tendency for moist currents from the Pacific to blow into the rear of the storm. General Greely has suggested that moist currents from Hudson Bay may also blow to the north of the storm and then circulate to the rear. Many more stations to the north and west will be needed to satisfactorily account for this anomaly. It is well known that in Europe more rain falls in the rear than in the front of storms, and in this case the ocean lies to the westward.

RISING PRESSURE TO THE SOUTH.

"General Greely, in 'American Weather,' has suggested a rule that when the pressure begins rising to the southwest it will shortly clear away in the regions toward the northeast, if it has been raining or threatening there. This rule is true in any part of the country, provided there is a sort of spontaneous rise in the pressure; I mean a rise not accompanied by a high area; but if a high area pushes south and the pressure rises on that account, the winds must first get well into the southwest and rather strong before the sky will thoroughly clear.

VERIFICATION OF WEATHER PREDICTIONS.

"It is well recognized that in a month where rains are frequent, and when they are more or less spontaneous; that is, when they do not accompany well marked storms, it is very much more difficult to forecast the weather than in other months when there is a strong persistency toward fair weather. The public, however, lose sight of these facts, and are inclined to measure the ability of one making forecasts by the percentage which is accorded in his month. This may be partially obviated by allowing for the rains in any month. In any case, however, the true method of verifying a prediction would seem to be by experts from the map on which the prediction was based, rather than on the resulting weather.

LOCAL FORECASTS.

"It seems probable that a wrong impression has gone abroad regarding the errors which arise in making forecasts at the central office in Washington. It is thought by many that serious failures have occurred from neglecting local signs. It can be shown readily that 95 per cent of the errors are due to rapid changes in the greater or more general movements of the atmosphere, and not to the neglect of local causes. These greater movements may be more carefully studied at a central office by experts than by local forecasters at their stations. There is a slight advantage which the local forecaster has, in that he can make his prediction three hours later than the main office, but aside from this there would seem to be a greater advantage at the central office than on station."

SUB-SOIL CONDITIONS.

The longer we live and the more we study Iowa farming the more we are impressed with the prime necessity of good soil conditions to get good crops of all kinds. The season's work with cultivated crops consists mainly in keeping the upper four inches in proper condition, dry enough, moist enough. Applications of manure do their good work on our rich soils by helping to keep good conditions, loosening the soil to admit the air being the principal. We roll the ground when it is too loose. We cultivate and harrow if it forms crusts, or becomes too compact. All this is conceded by intelligent farmers who make farming pay. Beyond this there is a prime consideration in dealing with the soil beneath this surface four inches, and this wet spring gives every farmer object lessons. The surface four inches will not do its best if the subsoil is saturated with water. The roots will not go down into stagnant water because they require the air to do their work, and the water excludes the air. The plant will not grow until the soil warms up, and a saturated soil will not warm up in our short growing season to enable plants to mature. Deep draining and tile laying are the only methods by which we can insure the soil conditions necessary, and while this is a well known fact, we doubt whether many of us fully appreciate the benefits of it. Every low lying field, or part of a field, would respond so much better if these necessary subsoil conditions were fully secured. Our lands have become valuable and this value depends upon the naturally dry acres that are in condition to yield. The wet acres do not pay us. They can be made to pay the most, as they generally have the deepest soils. Lay the tile deep. Get them down four feet or more. Many a mile of tile has been laid in Iowa that is not doing good work because it is too shallow. Then great care should be exercised in the laying. The deeper we go the better the soil is for laying tile in and the less danger of silt getting in, and the farther the drain will draw water. We would prefer drains every four rods four and a half feet deep to drains every two rods three feet deep. The fall must be attended to. Drains in our soil with little fall are apt to fill up with silt. Where heavy floods are frequent open ditches are necessary, and may as well be opened at once. They give outlets for laterals. There is very little Iowa land but can be dried, and all will be some day. The sooner it is done the sooner returns will come. PROF. JAS. WILSON.

APRIL METEOROLOGICAL REPORT.

The following report was received too late for publication in last month's review: West Bend, mean temperature 38.2; maximum temperature 76 on the 3d; minimum temperature 22 on the 13th; range, 54; rainfall, 2.64 inches; wind, northwest; rainy days, 5.

JULY NORMALS.

The Chief of the Weather Bureau directs the publication of the following data, compiled from the record of observations for the month of July, taken at this station for a period of fourteen years.

It is believed that the facts thus set forth will prove of interest to the public, as well as the special student, showing, as they do, the average and extreme conditions of the more important meterological elements and the range within which such variations may be expected to keep during any corresponding month.

TEMPERATURE: Mean or normal temperature, 74°

The warmest July was that of 1886, with an average of 78°.

The coldest July was that of 1882, with an average of 68°.

The highest temperature during any July was 104° on 5th and 6th, 1886.

The lowest temperature during any July was 50° on 1st, 1892.

PRECIPITATION: Average for the month 3 59 inches.

Average number of days with .01 of an inch or more, ten.

The greatest monthly precipitation was 8.64 inches, in 1892.

The least monthly precipitation was 0.27 inches, in 1886.

The greatest amount of percipitation recorded in any twenty-four consecutive hours was 2.31 inches, on July 9, 1881.

CLOUDS AND WEATHER: Average number of cloudless days, eleven.

Average number of partly cloudy days, fourteen.

Average number of cloudy days, six.

WIND: The prevailing winds have been from the southwest.

The highest velocity of the wind during any July was forty miles, on July 16, 1883.

GEO. M. CHAPPEL, M. D.,
Local Forecast Official.

MAY WEATHER REPORT.

The average temperature of the State for the month of May, 1893, as determined by the records of seventy-two stations, was 56.6°—about 3° below the normal. There have been four colder Mays within the past twenty years.

The average precipitation for the State, 3.45, was about 1.00 inch below the normal amount for the month. It was, however, quite well distributed, and ample for the needs of agriculture. There was more than the average amount of cloudiness, but on the whole the month was fairly good and favorable for planting and the germination of seed. It was much better than the corresponding month last year.

The following table gives, as a basis of comparison, the mean temperature and total rain-fall for the month of May, at the stations named, for the years from 1872 to 1893, inclusive:

YEARS.	MEAN TEMPERATURE, DEGREES.						PRECIPITATION, INCHES.					
	Des Moines.	Davenport.	Dubuque.	Keokuk.	Omaha.	Sioux City.	Des Moines.	Davenport.	Dubuque.	Keokuk.	Omaha.	Sioux City.
1872	....	....	....	63.8	61	....	.....	4.46	.....	3.70	6.35	.....
1873	....	59	....	61.0	59	....	.....	6.37	.....	3.42	5.59	.....
1874	....	64	65	66.6	66	....	.....	3.45	1.08	1.65	1.24	.....
1875	....	60	61	62.0	63	....	.....	2.01	3.62	6.70	4.25	.....
1876	....	62	62	63.2	63	....	.....	6.70	5.96	5.28	2.07	.....
1877	....	62	62	62.4	60	....	.....	2.82	3.84	5.55	8.62	.....
1878	....	58	56	59.3	58	....	.....	5.14	4.61	3.47	5.77	.....
1879	64	64	65	65.2	67	....	4.74	5.83	2.94	2.27	5.53	.....
1880	68	67	67	68.6	69	....	5.84	5.09	3.72	5.92	3.40	.....
1881	67	69	68	69.6	68	....	3.82	1.34	2.20	1.35	7.94	.....
1882	55	56	54	56.6	57	....	8.53	5 49	4.16	7.11	4.91	.....
1883	56	57	55	59.9	57	....	9.65	5.46	7.13	4.87	11.29	.....
1884	60	61	60	61.9	62	....	4.34	3.79	4.85	3.16	1.45	.....
1885	50	58	57	60.7	60	....	1.70	1.94	2 62	2.59	4.48	.....
1886	64	62	61	64.7	65	....	3.71	3.73	4.17	4.49	4.58	.....
1887	65	67	67	67.0	66	....	3 31	1.76	2.53	2.54	1.39	.....
1888	54	55	54	58.2	56	....	7.84	9.23	5.84	5.06	4.36	.....
1889	60	59	59	61.9	62	....	4.84	6.34	4.00	5.72	2.67	.....
1890	58	58	56	60.1	60	58	3.00	4.23	5.36	3.34	2.72	2.29
1801	58	58	58	60.5	59	59	3.79	2.74	2.54	2 56	4.94	2.41
1892	55	56	55	56.1	54	52	8.77	8.84	9.13	6.34	8.43	8.56
1893	57	58	57	59.8	59	57	2.84	2.67	3.06	4.36	3.84	3.17
Means	64	60	60	62 7	62	57	5.38	4.49	4.23	4.12	4.63	4.11

SUMMARY OF WEATHER CONDITIONS.

BAROMETER — Mean for the month, 29.91 inches. Highest observed, 30.31 inches, at Dubuque, on the 7th; lowest observed, 29.36 inches, at Davenport. Range for the State during the month, .95 of an inch.

TEMPERATURE — Monthly mean, 56.6°, determined from reports received from 72 Vol. Observers. Highest monthly mean, 61.3°, at Glenwood; lowest monthly mean, 51.4°, at Sac City. The highest temperature reported was 96°, at Glenwood, on the 9th; the lowest temperature reported was 26°, at Atlantic, on the 2d. Average daily maximum, 68.3°; average daily minimum, 45.5°; average monthly maximum, 84.3°; average monthly minimum, 32.3°. Greatest local range, 63°, at Atlantic and Glenwood. Least local monthly, 42°, at Delaware; range for the entire State, 70°.

PRECIPITATION—Average for the State, 3.45 inches, as determined from 76 voluntary observers' reports. The greatest amount reported, 5.82, at Carroll; the least amount reported, 1.65, at Sibley.

MISCELLANEOUS DATA —Average number of days on which .01 or more rain fell, 9.1. Average number of cloudy days, 8.6; part cloudy, 9.3; clear, 12.9.

THUNDER-STORMS occurred quite generally throughout the State; on the 4th, 11th, 22d, 28th, 30th and 31st.

HAIL—Atlantic, 10th; Alta, 11th, 22d; Clarinda, 22d; Cedar Rapids, 14th; Des Moines, 22d; Eagle Grove, 28th; Glenwood, 10th; Greenfield, 28th; Iowa Falls, 22d; Oskaloosa, 26th.

FROST was reported quite generally throughout the State on 2nd, 3d, 4th, 6th, 23d and 26th.

HALO, SOLAR, 22d at Alta; Ames, 12th; Hopeville, 17th; 24th.

HALOS, LUNAR, 22d at Alta; Ames, 27th; Hopeville, 21st.

HIGH WINDS, Alta, 10th; Cresco, 22nd; Centerville, 22nd; Panama, 17th, 18th; Sibley, 22nd; Tipton, 5th, 11th.

ATMOSPHERIC PRESSURE.

STATIONS.	Mean actual barometer.	Mean reduced barometer.	EXTREMES. Highest barometer	Date.	Lowest barometer	Date.
Cresco	.....	.....	30.34	7	29.56	22
Clarinda	.....	29.92	30.23	7	29.45	22
Davenport	.....	29.88	30.26	7	29.36	22
Des Moines	28.99	29.91	30.26	7	29.46	22
Dubuque	.....	29.90	30.31	7	29.42	22
Keokuk	29.25	29.91	30.24	7	29.44	22
Omaha, Neb	.....	29.93	30.27	7	29.42	22
Sioux City	.....	29.90	30.26	7	29.42	21
Means	.....	29.91	30.31	7	29.36	22

WIND MOVEMENT.

STATIONS.	Miles.	Maximum velocity.	Direction.	Date.
Davenport	7,843	42	SW	22
Des Moines	6,908	35	SW	19
Dubuque	4,847	38	W	11
Keokuk	5,709	36	W	12
La Crosse, Wis	5,936	36	NE	22
Omaha, Neb	6,405	36	NE	22
Sioux City	8,713	64	NW	21

OBSERVERS' NOTES.

Atlantic.—J. W. LOVE: During the thunderstorm of the 10th inst, lightning struck a barn, 3 miles west of town, which was totally consumed, together with a team of mules, cow, calf, wagon hay, harness, grain, etc.

College Springs.—A. A. BERRY: May has been a very favorable month and crops of all kinds have prospered finely. Fall wheat looks well; oats good. Pigs are in hard luck and fully 60 per cent less than last year. Considerable replanting has been done on account of weak seed and cut-worms.

Monticello.—HENRY D. SMITH: Corn planting began the 8th; strawberries in blossom, 9th; currants and gooseberries, 14th; apple blossom, 19th, in full bloom, 22d. Max. temperature since 1854, 95°, 1856; minimum 25° in 1885. Greatest precipitation, 8.63 inches in 1892.

Panama.—WM. J. WICKS: Seven head of cattle killed near town on the 21st.

Clinton.—DR. LUKE ROBERTS: The first seven days of May, 1893, were cool, the minimum temperature ranging between 31° and 39°. A little rain on the 1st, frost on the 3d, and frost and rain on the 4th, and frost on the 6th. These frosts were light and the only frosts of the month. The range of the minimum temperature for the remainder of the month was between 38° and 62°. The 38° degree mark was reached only once—on the 18th, and on the 22d it touched 62°.

The lowest maximum temperature was 50°, on the 1st and 5th, and the highest maximum temperature was 86°, on the 10th. It was also above 80° on the 19th, 20th, 21st 22d, 29th and 30th. The maximum temperature was .4° below normal. The highest for May during the last twelve years was 92°, in 1889.

The mean temperature for the month was 57.3°; 2.3° above normal. The highest monthly mean for May during the last fifteen years was 66.9°, in 1887, and the lowest mean for the same period was 55.2°, in 1888. The warmest day was the 21st, the mean temperature being 70.2°. The warmest May day during the last fifteen years was the 28th, in 1881, the mean temperature being 79°. The coldest May day for the same period was the 7th, in 1885, the mean being 37.5°.

The rainfall for the month was 3.8 inches. This is .70 inches below a fifteen years' normal. The greatest monthly rainfall for May during the last fifteen years was 8.41 inches. This was in 1892.

The number of storm days in the month was twelve and the greatest precipitation during twelve consecutive hours was 1.30 inches, this was on the 31st, commencing at 1 p. m. and ending at midnight. A little hail accompanied this storm at 1:15 p. m.; thunder was heard at 12:45 p. m. and a heavy clap resounded at 1:15.

There were eight cloudy and eight clear days, all being a little above normal. Cloudiness was 50 per cent of the surface of the sky, or 2 per cent above normal.

The prevailing direction of the wind was northwest, which was something unusual for May, as it has not occurred before during the last fifteen years. The total movement of the wind for the month was 4,700 miles; this was about a May normal. Maximum velocity, 23 miles an hour. For about five minutes during the storm of the 31st it must have exceeded that somewhat, but the duration was so short that an accurate measurement could not be had. A few small limbs were broken from trees.

The month, as a whole, compares favorably with the average May meteorological conditions and closed leaving bright prospects for a general harvest.

MAY STORMS.

The month of May brought its usual quota of severe storms of a local character. The periods of greatest storm energy were about the 10th and 11th, and the 21st and 22d.

On the night of the 10th a wind squall passed three miles west of Dunlap. It was accompanied by hail in streaks, and a number of buildings were damaged. The same storm swept through Charter Oak, Crawford county. On the same night severe storms were reported at Williams, Hamilton county; Iowa Falls, Hardin county; Coon Rapids and Grundy Center. At Council Bluffs D. W. Patterson was killed by lightning, and at Burt J. B. Jones was the victim of the same deadly force.

The storm of the 21st and 22d was especially severe at Nora Springs, Armstrong, Hastings, Holstein, Hampton, Goldfield, Gilmore City, Alta and Sioux City. These disturbances were of the usual character of summer thunder squalls. No tornado visited Iowa during the month.

SOLAR OBSERVATIONS, MAY, 1893.—ALTA, IOWA

BY DAVID E. HADDEN.

Date.	CENTRAL TIME.	NUMBER VISIBLE: Groups.	NUMBER VISIBLE: Spots.	Faculæ.	Definition.	REMARKS.
2	5:30 P. M.	9	*60	4	Poor..	2 groups by rotation on E. limb. A group is disappearing on W. limb. A large group is near meridian S. latitude, with large spot and numerous smaller spots.
3	5:10 P. M.	8	58	5	Good..	A new group is on N. E. limb.
7	3:00 P. M.	8	*28	3	Fair...	A new group in large faculæ is in, on E. limb one group is N. W. All others in southern hemisphere.
10	11:30 A. M.	6	.....	.....	Poor..	Group and faculæ by rotation
12	11:45 A. M.	10	18	4	Good..	Mottling of faculæ E. limb. Groups and spots small.
13	5:30 P. M.	8	16	3	Good..	New small groups by solar rotation N. latitude.
14	4:30 P. M.	8	17	5	Fair...	New small group in faculæ by rotation. All groups small.
15	5:15 P. M.	8	21	5	Fair...	New small group by rotation E. limb. N. group on west limb is disappearing by rotation. Large area of facula E. limb.
16	5:15 P. M.	8	23	2	Good..	Faculæ by rotation E limb. East of group yesterday.
17	5:15 P. M.	8	23	4	Good..	New small group in faculæ, in by rotation E. limb. All the groups are small. New facula by rotation.
18	5:20 P. M.	7	26	5	Good..	Small facula by rotation on S. E. limb. Extensive area of faculæ S. E. quadrant.
19	5:45 P. M.	6	19	5	Good..	New small group on E. limb. A large group near W. limb.
20	5:30 P. M.	6	21	7	Good..	New group by rotation. Faculæ on S. E. limb by rotation.
21	4:30 P. M.	6	.....	6	Fair...	New small group in faculæ S. E. limb. The large group is disappearing by solar rotation on W. limb.
23	5:15 P. M.	8	30	6	Good..	New group in faculæ E. Facula by rotation.
26	5:20 P. M.	9	47	3	Fair...	New group on edge of E. limb by rotation. Also new group about one day in. Large double group N. latitude with extensive penumbra and many dark spots; the groups in S. latitude extend across the disc from E. to W.
27	5:20 P. M.	11	52	7	Good..	New group on edge of limb by rotation; also small group by rotation farther N. Fine double group N. latitude.
28	5:00 P. M.	11	45	4	Good..	The large group N. has now divided, forming two distinct groups, one of which is about on meridian. A fine group of spots is near the E. limb south of sun's equator, containing spots of umbra and penumbra and surrounded by extensive areas of faculæ. Granulation distinct.

*About.

METEOROLOGICAL DATA FOR MAY, 1893.

STATIONS.	TEMPERATURE OF THE AIR (IN DEGREES FAHRENHEIT).								PRECIPITATION IN INCHES.			Prevailing direction of wind.	No. of rainy days. (.01 inch or more).	No. of cloudy days.	No. of fair days.	No. of clear days.	No. of hail-storms.	No. of thunder-storms.
	Monthly mean.	EXTREMES. Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Monthly range.	Monthly, including melted snow.	Total monthly snowfall.	Depth of unmelted snow at end of month.							
Algona	57.0	+ 86	10	.....	+ 36	1	.....	50	2.31	.....	.....	N W	8	4	14	13	..	4
Alta	54.6	86	21	66.2	31	2	43.0	55	3.65	.....	.....	SE&NW	11	7	10	14	1	4
Ames (W. R. Cooper)	55.0	83	21	67.0	31	3	42.0	52	4.33	.....	.....	.....	9	8	11	12	..	..
Ames (E. N. Eaton)	.....	.....	.....	.....	.....	.....	.....	.....	4.25	.....	.....	.....	10	.....	.....	.....	.....	12
Ames (four miles southwest of)	54.5	+ 82	10-21	.....	+ 32	3	.....	50	4.89	.....	.....	N W	13	.....	.....	.....	12	12
Amana	56.5	85	19	68 2	32	3	44.7	53	2.29	.....	.....	N E	9	5	13	12	1	4
Atlantic	57.4	89	13-29	72.5	26	2	42.2	63	3.64	.....	.....	N	9	11	8	12	1	1
Audubon	58.0	90	20	72.7	28	3	43.5	62	4.54	.....	.....	N W	6	11	14	6	..	..
Belle Plaine	56.6	85	10	67.9	30	3	43.0	55	3.24	.....	.....	N W	10	9	10	12	1	5
Blakeville	55.3	.....	.....	.....	.....	.....	.....	.....	3.36	.....	.....	N W	7	12	7	12	..	3
Bonaparte	58.3	86	20	70.5	34	2	46.0	52	4.31	.....	.....	.....	.....	.....	.....	.....	.....	.....
Carroll	56.7	84	21	67.7	31	3	45.7	53	5.82	.....	.....	.....	9	9	10	12	1	3
Cedar Rapids	57.2	81	19	66.6	34	6	47.9	47	2.79	.....	.....	N E	12	9	7	15	1	3
Centerville	60.1	88	19-20	70.2	38	1	50.1	50	5.14	.....	.....	N W	13	8	6	17	1	2
Charles City	54.2	82	21	65.7	28	4	42.6	54	2.72	.....	.....	N W	8	.....	.....	.....	.....	1
Clarinda	57.9	82	21	68.1	32	2	47.6	50	3.17	.....	.....	N E	8	9	3	19	1	..
Clinton	57.6	86	10	.....	31	6	.....	55	3.80	.....	.....	N W	12	9	15	7	1	..
College Springs	58.5	+ 85	21	71.1	+ 34	2	46.0	51	3.61	.....	.....	N	8	10	7	14	..	..
Corning	57.1	82	10	69.1	29	2	45.1	53	3.27	.....	.....	N E	8	9	6	16	..	1
Cresco	52.9	82	21	65.0	30	4	41.5	52	2.79	.....	.....	.....	10	.....	.....	.....	.....	3
Davenport	58.0	83	22	70.2	37	4	48.2	46	2.67	.....	.....	N E	12	11	12	8	..	..
Delaware	55.1	+ 82	19-21	.....	+ 40	5	.....	42	2.92	.....	.....	N W	13	6	16	9	..	3
Denison	.....	.....	.....	.....	.....	.....	.....	.....	5.21	.....	.....	.....	.....	.....	.....	.....	.....	.....
Des Moines	57.0	83	21	66.9	33	3	46.9	50	2.84	.....	.....	N W	13	21	5	5	1	4
Dubuque	57.0	82	19	65.8	34	3	47.4	48	3.06	.....	.....	W	14	13	10	8	..	..
Eagle Grove	55.4	+ 82	17	62.5	+ 34	3	48.3	48	4.35	.....	.....	S E	7	6	8	17	2	1
Elkader	55.2	85	19	68.0	29	3-4	42.3	56	2.63	.....	.....	.....	11	6	10	15	..	2
Emmetsburg	55.3	85	21	68.9	40	4	41.7	55	3.54	.....	.....	N	5	15	5	11	1	..
Estherville	54.4	82	10-21	66.9	30	4	.....	52	3.51	.....	.....	S	5	.....	.....	.....	.....	..
Glenwood	61.3	96	29	74.0	33	2	48.6	63	4.93	.....	.....	N	6	7	11	13	1	..
Grand Meadow	54.7	+ 80	14	.....	+ 36	1	.....	44	3.18	.....	.....	N W	11	8	8	15	..	..
Greenfield	57.9	85	20	70.5	31	2	45.5	54	3.49	.....	.....	N W	15	9	4	18	2	2
Grinnell	54.9	77	21	62.4	34	1	47.1	43	2.85	.....	.....	N	12	12	6	13	..	2
Grundy Center	55.2	82	10	64.8	34	3	45.6	48	2.70	.....	.....	N W	9	.....	.....	.....	1	2
Hampton	53.6	83	21	65.5	29	4	42.2	54	2.64	.....	.....	N W	8	5	15	11	..	3
Humboldt	.....	.....	.....	.....	.....	.....	.....	.....	2.29	.....	.....	E	6	..	.....	.....	1	..
Hawkeye	.....	.....	.....	.....	.....	.....	.....	.....	3.18	.....	.....	.....	9	.....	.....	.....	.....	.....
Hopeville	57.4	83	20	67.9	33	2	46.9	50	3.35	.....	.....	N	10	7	18	6	..	6
Hopkinton	56.5	+ 80	21	65.5	+ 36	4	47.5	44	3.23	.....	.....	.....	.....	.....	.....	.....	.....	.....
Independence	54.8	84	21	.....	28	4	.....	56	2.52	.....	.....	E	7	5	9	17	..	..
Indianola	58.0	83	21	69.3	30	3	46 7	53	4.78	.....	.....	S W	12	8	13	10	3	4
Iowa City	57.4	85	19	70 4	31	3	44.5	54	1.79	.....	.....	N W	11	5	17	9	..	3
Iowa Falls	54.4	82	21	66.2	30	4	42.7	52	3.84	.....	.....	E	6	9	6	16	1	1
Jefferson	59.0	86	21	69.6	29	3	45.2	57	5.50	.....	.....	N W	14	5	21	5	..	8
Keokuk	59.8	85	20	69.2	39	2	56.2	46	4.36	.....	.....	N W	12	7	12	12	..	..
Keosauqua	59.4	89	20	70.8	36	2-3	48.1	53	4.48	.....	.....	.....	9	.....	.....	.....	.....	.....
Larrabee	55.8	87	21	69.0	32	2-3	42.6	55	4.11	.....	.....	.....	8	9	9	13	..	4
Logan	58.5	86	10-13	70.4	32	2	46.6	54	4.73	.....	.....	S W	7	11	4	16	..	..
Maquoketa	57.4	.....	.....	.....	.....	.....	.....	.....	1.77	.....	.....	.....	.....	.....	.....	.....	.....	.....
Marshalltown	57.1	81	22	67.3	35	3	46.9	46	3.10	.....	.....	N	7	8	4	19	..	..
Makon	57.7	.....	.....	.....	.....	.....	.....	.....	3.38	.....	.....	.....	8	3	21	7	..	3
Mechanicsville	57.9	82	19	66.1	33	4	43.6	49	3.15	.....	.....	S	10	13	8	10	..	2
Monticello	54.8	+ 83	22	66.3	+ 28	4	43.2	55	2.57	.....	.....	N W	13	7	7	17	..	2
Mount Vernon	57.9	84	21	.....	36	3	.....	48	2.35	.....	.....	.....	.....	.....	.....	.....	.....	.....
Mount Ayr	59.0	87	20	70.6	33	2	47.1	54	5.09	.....	.....	.....	8	9	6	16	..	..
Murray	56.4	85	20	67.6	32	2	46.0	53	4.44	.....	.....	N W	12	12	7	12	1	2
Newton	57.4	84	19	69.6	33	3	45.2	51	2.92	.....	.....	N W	10	8	6	17	1	..
Omaha (Neb.)	59.0	86	10	68.7	36	1	49.3	50	3 84	.....	.....	N E	8	8	5	18	..	..
Ovid	59.9	.....	.....	.....	.....	.....	.....	.....	3.26	.....	.....	.....	.....	.....	.....	.....	.....	.....
Osage	52.6	.....	.....	.....	.....	.....	.....	.....	3.85	.....	.....	N W	11	15	7	9	..	3
Oskaloosa	57.1	84	2	68.0	31	3	46.1	53	2.70	.....	.....	N W	6	12	3	16	..	..
Panama	56.7	82	10-20	68.1	33	1-2	45.2	49	5.17	.....	.....	N W	8	10	4	17	2	1
Rock Rapids	56.2	86	13	70.5	32	5	41.8	54	4.69	.....	.....	S	5	5	10	16	..	2
Richland	58.4	.....	.....	.....	.....	.....	.....	.....	3.24	.....	.....	.....	10	4	22	5	..	..
Sac City	51.4	80	21	59.9	33	3	42.8	47	2.25	.....	.....	SW&NW	2	12	4	15	1	..
Seymour	58.2	85	20-22	69.9	32	2	46.5	53	3.70	.....	.....	N E	11	7	5	19	..	..
Sibley	55.2	82	14	69.5	28	3	40.5	54	1.65	.....	.....	N W	6	5	11	15	..	2
Sioux City	57.0	87	10	67.9	37	13	46.1	50	3.17	.....	.....	N	9	11	8	12	..	..
Storm Lake	56.3	82	13	67.4	33	1	45.2	49	3.41	.....	.....	S E	8	7	12	12	2	2
Tipton	58.7	87	19	69.6	34	2-4	45.4	53	2.93	.....	.....	N W	13	12	5	14	1	3
Villisca	59.7	85	30	71.1	34	2	48.3	51	2.96	.....	.....	N W	10	..	.....	.....	.....	.....
Vinton	55.8	+ 82	21	70 2	+ 35	4	40.8	47	2.60	.....	.....	N W	8	6	9	16	1	..
Washington	59.9	† 92	30	71.1	+ 35	3	48.6	57	1.74	.....	.....	N E	10	.....	.....	.....	1	..
Webster City	54.7	+ 86	19-20	.....	+ 33	1	.....	53	3.62	.....	.....	N W	6	6	11	14	..	4
West Bend	54.6	.....	.....	.....	.....	.....	.....	.....	1.92	.....	.....	N W	4	5	13	13	1	2
Williams	54.3	+ 83	21	.....	+ 36	1	.....	47	3.68	.....	.....	N W & E	12	5	13	13	2	4
Mean	56 6	96	29	68.3	26	2	45.5	51.6	3 45	.....	.....	N W	9 1	8.6	9.3	12.9	37	110

†Taken from observed reading. All others self-registering instruments.

DAILY AND MONTHLY MEAN TEMPERATURE FOR MAY, 1893.

STATIONS.	DATE.																															Monthly Mean.
	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	31st.	
Algona	42	45	45	47	46	52	52	54	58	68	60	58	62	62	57	55	60	67	66	64	72	48	55	57	58	51	54	56	66	66	64	57.0
Alta	40	48	46	39	43	46	50	48	54	67	57	58	62	62	50	55	60	65	67	62	68	44	47	57	50	49	52	59	65	65	64	54.6
Ames (W. R. Cooper)	41	44	46	42	44	44	50	50	53	65	66	60	60	62	59	56	56	56	67	64	64	52	54	60	48	47	52	54	65	63	60	55.0
Ames (Isaac Young)	41	44	46	40	45	50	53	48	56	72	58	59	62	63	51	54	60	62	68	68	69	49	56	58	48	46	56	57	66	65	58	54.5
Amana	42	46	44	44	46	46	50	51	58	68	62	60	59	64	52	54	56	57	60	66	66	54	64	52	50	56	56	64	66	62	56	5
Atlantic	44	44	48	48	46	46	51	48	60	64	64	62	68	68	56	56	58	65	79	63	67	62	55	63	49	50	54	60	67	64	62	57.4
Audubon	45	48	54	45	53	40	53	48	61	68	61	58	64	70	56	59	62	62	68	69	60	52	62	48	50	50	58	58	72	65	64	58.0
Belle Plaine	41	46	44	43	46	46	49	50	59	69	60	59	56	62	53	54	54	58	68	66	66	58	54	64	52	50	54	54	64	65	62	55.5
Blakeville	39	42	42	44	46	46	52	50	58	64	58	56	57	62	58	58	57	60	64	66	66	54	58	56	52	50	55	56	62	65	62	55.3
Bonaparte	44	50	48	44	48	50	49	52	60	68	62	60	60	65	56	54	56	59	69	70	70	56	62	54	52	56	59	66	72	62	58.3	
Carroll	38	43	46	45	44	48	48	49	55	68	66	59	61	61	54	57	60	58	62	68	73	50	59	60	52	55	55	62	72	70	60	56.7
Cedar Rapids	44	49	42	48	46	48	50	52	60	66	66	58	58	62	55	52	56	58	68	66	68	56	62	54	56	56	58	65	66	61	57.2	
Centerville	53	56	57	55	39	58	54	50	61	70	64	65	60	65	58	62	58	62	74	76	74	70	56	62	44	45	55	56	70	68	64	60.1
Charles City	39	46	43	40	47	46	48	51	58	66	66	58	56	56	54	45	54	56	68	68	62	61	54	48	49	52	52	56	68	63	54	54.2
Clinton	44	47	46	47	44	44	52	54	63	67	64	54	58	60	59	58	58	58	67	65	64	74	54	64	55	51	58	59	64	66	64	57.6
Clarinda	41	46	53	51	48	48	50	48	58	68	60	61	63	68	56	58	60	64	71	64	71	66	46	50	46	50	54	58	66	66	61	57.9
College Springs	43	48	54	48	50	50	52	52	60	68	66	60	64	69	60	60	63	60	66	68	68	59	60	60	46	52	56	58	67	67	61	58.5
Corning	42	44	49	47	48	47	49	48	57	68	64	47	61	68	58	58	56	63	70	64	68	60	54	66	48	48	53	58	66	64	64	57.1
Cresco	38	42	42	42	46	44	49	52	58	62	58	50	54	59	50	52	54	58	68	60	61	54	50	48	48	48	50	54	64	62	62	52.9
Davenport	43	46	48	46	44	48	50	51	30	66	64	60	56	62	56	55	58	60	68	70	68	74	51	64	49	54	56	58	68	68	64	58.0
Delaware	40	45	45	44	44	46	50	48	57	67	59	52	53	58	52	54	57	59	68	65	70	58	53	65	50	48	55	59	67	66	57	55.1
Des Moines	42	46	46	44	48	48	50	49	58	69	62	62	62	64	54	58	59	62	71	69	70	53	54	66	47	48	54	56	68	66	61	57.0
Dubuque	42	46	44	46	44	46	51	51	60	67	65	62	56	61	55	56	58	59	70	68	65	67	54	66	53	49	57	58	66	66	64	57.0
Eagle Grove	40	40	44	41	52	48	50	50	57	66	56	57	62	60	52	58	62	60	70	65	69	46	52	52	50	49	55	61	68	68	59	55.4
Elkader	40	46	44	44	46	46	48	50	60	64	61	52	57	59	52	54	54	56	68	64	62	58	54	66	54	49	56	56	64	64	63	55.2
Emmetsburg	40	42	48	41	44	48	52	52	57	66	60	58	61	60	52	54	58	62	67	63	65	57	52	58	48	47	54	58	64	63	64	55.3
Estherville		40	44	39	45	44	48	46	55	66	64	56	60	62	52	54	66	62	66	62	62	66	52	55	48	51	53	58	64			54.4
Glenwood	44	50	55	48	47	49	50	50	58	72	68	64	71	72	59	59	59	68	76	70	70	66	62		58	54	63	66	74	71	65	61.3
Grand Meadow	38	42	44	44	46	46	52	57	58	67	61	52	52	62	51	52	56	62	68	63	68	50	54	59	53	48	50	57	66	65	61	54.7
Greenfield	42	46	48	46	47	48	51	48	60	67	62	62	62	66	56	60	68	70	67	69	58	54	66	67	46	47	52	62	67	65	60	59.4
Grinnell	37	43	46	42	44	46	48	54	66	62	58	56	60	53	54	56	62	68	66	67	61	56	63	46	48	55	57	64	66	61	54.9	
Grundy Center	40	45	44	48	46	49	51	50	60	69	59	58	61	62	50	54	54	66	68	67	70	51	56	58	53	49						55.2
Hopkinton	42	48	50	46	44	47	52	50	58	65	64	52	56	61	52	54	55	59	66	68	67	64	53	64	52	50	56	58	67	68	62	56.5
Hopeville	42	46	50	47	47	48	49	48	58	67	64	60	63	67	55	56	58	72	71	69	70	62	55	65	48	48	54	58	66	65	62	57.4
Hampton	38	40	42	42	46	48	49	50	56	64	60	57	55	60	48	54	55	58	66	63	64	48	52	60	48	47	51	50	64	64	62	53.6
Independence	42	44	46	44	43	49	50	49	58	66	58	54	54	59	52	54	58	57	65	66	70	51	52	57	50	48	54	57	65	69	58	54.8
Indianola	41	44	45	49	46	47	48	51	57	68	69	63	62	66	58	57	58	64	71	69	69	64	54	66	57	47	53	58	67	66	62	58.0
Iowa City	43	48	46	44	46	48	48	52	60	67	68	60	59	60	56	55	58	57	62	65	66	73	55	63	60	51	58	56	64	66	67	57.4
Iowa Falls	38	42	43	42	44	46	48	49	57	67	60	58	56	60		53	55	58	60	64	64	52	52	60		48	52	50	65	63	61	54.4
Jefferson	42	45	46	48	46	45	53	45	59	67	72	58	65	74	66	55	55	62	69	74	81	66	53	62	58	50	53	59	68	65	61	59.7
Keokuk	44	49	51	48	51	51	50	53	60	68	66	62	62	66	60	56	58	62	73	74	70	76	56	65	50	54	56	62	68	70	62	59.8
Keosauqua	44	47	50	45	48	49	50	53	60	60	64	63	64	68	59	56	57	60	72	73	68	72	60	66	56	53		58	67	72	62	59.4
La Crosse, Wis	38	44	45	46	44	50	53	56	58	66	64	51	54	59	54	54	57	59	69	66	66	56	51	62	54	52	54	58	66	64	66	56.0
Larrabee	38	42	46	40	44	46	50	47	57	68	56	58	62	62	51	54	61	65	68	62	68	59	52	58	50	53	52	62	65	64	67	55.8
Logan	42	46	50	48	44	45	50	50	64	74	54	66	65	60	62	60	62	70	71	67	72	60	58	52	51	54	57	62	68	64	66	58.5
Maquoketa	43	46	46	45	48	48	51	54	62	66	62	54	55	60	55	52	52	58	64	65	70											55.2
Marshalltown	44	45	45	48	41	47	44	53	50	66	67	58	58	66	60	55	58	58	72	67	66	66	52	64	58	50	52	58	65	68	66	57.1
Maxon	42	44	49	46	47	50	50	50	59	71	60	63	62	66	53	57	56	65	69	68	72	62	56	66	44	50	56	61	68	70	60	57.7
Mechanicsville	40	45	45	44	44	46	48	50	57	64	64	57	54	58	52	52	54	56	66	64	65	66	53	61	48	48	55	56	62	64	60	54.9
Monticello	40	44	44	46	41	47	53	51	61	67	59	54	53	60	54	54	54	58	67	62	69	60	52	65	51	50	54	67	66	68	60	55.5
Mt. Vernon	42	46	44	42	44	51	56	54	63	70	61	58	59	62	62	54	58	61	68	62	73	63	54	66	53	54	56	59	68	68	64	57.9
Mt. Ayr	44	48	53	50	50	49	50	48	60	67	62	66	64	66	58	57	62	63	72	72	69	62	56	65	62	50	56	58	70	69	61	59.0
Murray	42	44	48	46	48	47	48	49	56	62	64	58	64	64	56	57	57	62	69	61	68	61	55	65	45	47	54	60	68	65	62	56.8
Newton	41	46	46	42	45	47	50	52	59	63	66	61	61	69	56	56	57	61	76	69	68	62	55	65	58	48	55	56	66	67	62	57.4
Omaha, Neb	43	48	53	48	46	48	52	50	56	70	62	64	66	68	57	60	63	68	72	70	72	48	57	64	49	53	58	64	68	67	64	59.0
Osage	38	41	42	41	45	46	48	48	56	62	59	52	54	58	50	52	53	59	63	59	64	46	50	52	50	50	51	56	64	63	61	52.6
Oskaloosa	44	46	46	42	46	46	48	50	57	68	65	61	64	64	56	58	56	61	71	70	68	62	58	65	45	48	55	54	67	67	63	57.1
Ovid							52	48	58	70	60	59	65	64	54	56	59	62	68	69	68	63	58	67	44	48	54	60	66	67	60	59.9
Panama	41	44	48	46	46	44	50	46	56	68	62	58	62	66	55	66	62	68	60	66	68	60	52	60	48	50		66	64	65	64	56.7
Rock Rapids	40	43	46	42	42	47	56	53	59	67	59	56	64	56	54	55	65	68	57	68	69	59	62	56	60	48	54	58	64	63	64	56.2
Richland	42	47	53	46	46	44	47	49	56	72	62	60	58	70	54	56	60	62	71	72	74	67	57	70	48	50	61	63	65	70	59	58.4
Sac City	39	40	47	40	45	48	54	48	52	50	50	44	42	46	50	53	54	54	58	62	64	45	53	54	50	46	57	58	63	64	60	51.4
Seymour	42	44	50	50	45	48	50	51	58	67	66	65	62	66	58	57	57	61	70	69	69	71	54	64	57	49	54	55	71	62	63	58.2
Sibley			42	44	43	46	41	47	55	66	60	56	59	57	58	59	58	60	66	59	64	59	52	58	48	52	50	54	58	64	63	55.2
Sioux City	42	45	46	41	44	48	51	47	54	70	59	67	66	66	52	58	60	66	71	66	70	48	54	60	50	52	54	62	68	66	67	57.0
Storm Lake	40	44	47	42	44	46	51	49	56	66	63	59	64	64	51	58	58	64	68	66	66	60	52	62	48	49	54	62	67	65	64	56.3
Tipton	42	44	50	46	44	47	52	51	62	69	60	52	61	57	52	56	56	63	70	68	72	62	57	62	50	52	57	63	68	70	64	57.5
Villisca		44	50	56	49	48	51	54	52	58	68	60	64	65	66	56	60	66	66	68	72	76	58	58	65	54	53	60	65	64		59.7
Vinton	41	43	44	45	43	48	52	51	59	70	59	58	58	61	51	54	56	60	67	66	70	55	55	62	50	50	55	56	65	66	59	55.8
Washington	48	50	52	53	52	54	50	54	62	76	70	64	62	66	58	50	59	70	77	76	78	70	58	72	50	54	60	60	70	76	63	59 9
Webster City	37	41	45	44	44	53	54	49	59	71	61	58	58	58	54	51	58	62	64	65	65	45	52	54	50	48	53	53	64	64	62	54.7
West Bend	38	41	44	43	43	47	49	49	56	69	56	56	61	59	52		59	63	63	62	73	46	53	54	53	46	54	50		68	70	54.6
Williams	38	41	43	43	43	47	50	48	55	68	56	56	58	60	52	54	59	64	63	63	69	46	55	54	51	46	54	60	65	68	60	54.5

MAXIMUM AND MINIMUM TEMPERATURE FOR MAY, 1893.

| STATIONS. | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | | 9 | | 10 | | 11 | | 12 | | 13 | | 14 | | 15 | | 16 | | 17 | | 18 | | 19 | | 20 | | 21 | | 22 | | 23 | | 24 | | 25 | | 26 | | 27 | | 28 | | 29 | | 30 | | 31 | | Monthly Mean. | |
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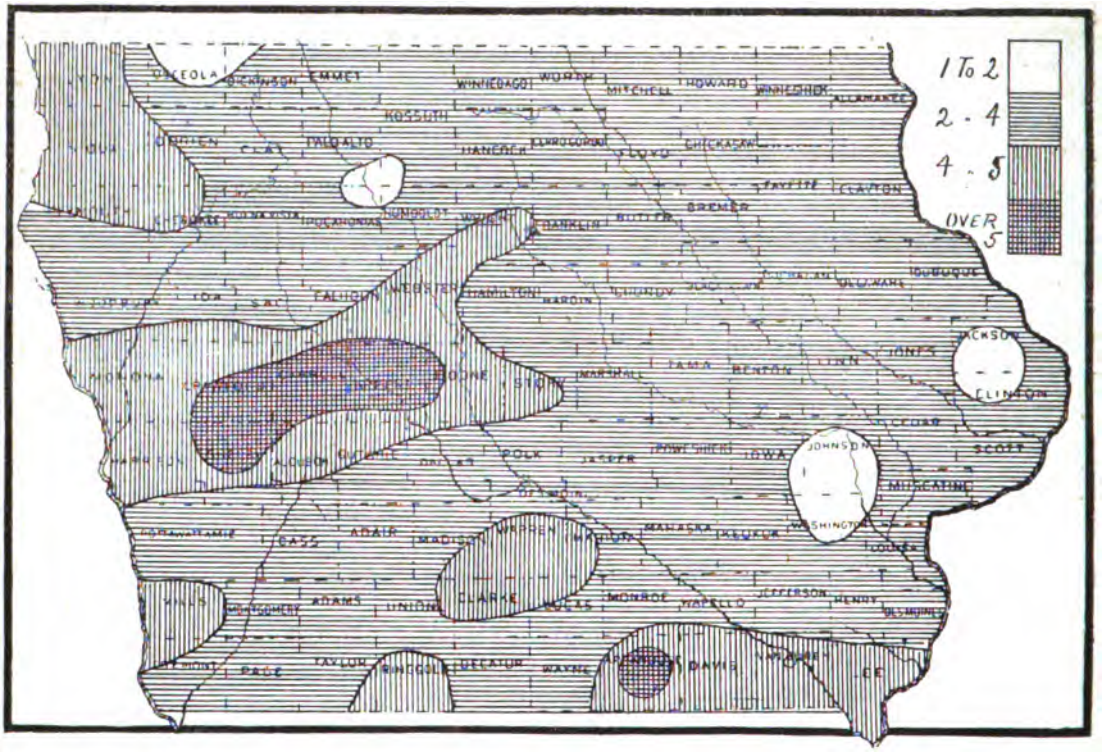
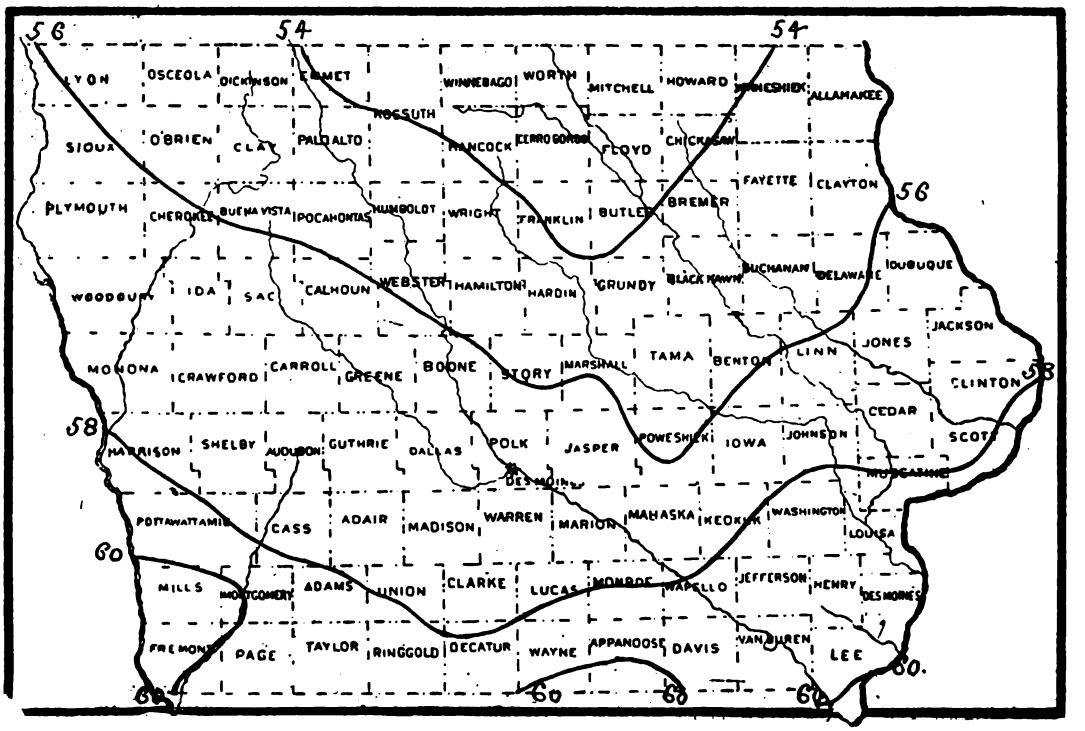
DAILY AND MONTHLY PRECIPITATION FOR MAY, 1893.

STATIONS.	DATE. 1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th	27th.	28th.	29th.	30th.	31st.	Total.
Algona	0.08			0.60	0.15			T		0.30	0.09		0.05								0.70	0.34				T				T	2.4
Alta	0.02			1.17	0.03			0.23	T	0.20	0.15	0.09										1.50			0.03	0.03				0.20		3.6
Ames (W. R. Cooper)				0.40				0.20			1.33										0.00		0.22			0.25		0.59		0.14	0.30	4.3
Ames (E. M. Eaton)	T			0.38				0.19		1.34				0.08								1.11			0.12	0.13		0.47		0.14	0.29	4.26
Ames (Isaac Young)	0.50				0.33			0.18			1.55			0.50								0.85				0.18		0.10		0.50	0.20	4.76
Amana	0.12				0.37						0.38			0.22								0.16	0.15			0.34	0.11				0.44	2.38
Atlantic				0.34				0.49	T	1.55	0.34											0.64				0.05		0.11			0.12	3.64
Audubon				0.37				0.74			1.62			0.04								1.67				0.10						4.54
Belle Plaine				0.28				0.06			1.39			0.10	T							0.06	0.02		0.49	0.18		0.02			0.64	3.24
Blakeville					1.00			0.12			0.76											0.70				0.50		0.18				3.36
Bonaparte					0.25				0.27			0.33														1.37	0.52		0.30	0.06	0.75	4.31
Carroll				0.45				0.65			1.40	0.12		0.06								2.63		0.13		T		0.15		0.23		5.82
Cedar Rapids	0.23		T	T	0.53	T		T	0.05		0.43	0.11		0.17		T						0.12	0.31			0.65	0.14		0.05			2.79
Centerville	0.05			0.08	1.00			0.74			0.30												0.07		1.00	1.10		0.12		T	0.58	5.14
Charles City	T			0.72	0.02			0.03		0.15	0.68	0.09	T									0.88				0.15						2.72
Clarinda				0.18				0.61			1.44										T	0.10			0.39	0.39		0.06				3.17
Clinton	0.10			0.20	0.42			0.03			0.57	0.09		0.14								0.08	0.57		0.20	0.10					1.30	3.80
College Springs				0.21				0.61	T		1.47										0.07	0.12			0.76	0.27		0.10	T			3.61
Corning				0.21			T	0.90			1.30			T								0.11			0.16	0.31		0.05	T		0.23	3.27
Cresco	0.11				0.70			0.08		0.25	0.26	T		0.12	0.02							1.07				0.15					0.03	2.79
Davenport	0.11			0.04	0.23			0.03			0.58			0.14	T							0.37	0.64		0.09	0.02	0.06		T		0.36	2.67
Delaware	0.13			0.48	0.13			0.05		0.69		0.01		0.13	0.01							0.20			0.29	0.19	0.01				0.60	2.92
Denison				0.43				0.89		1.38				0.09							1.38	1.01			T				0.03			5.21
Des Moines		T		0.15	0.20		T	0.23	T	T	0.96			0.14								0.25	0.01		0.04	0.20	T	0.30		0.01	0.31	2.84
Dubuque	0.27		0.02	0.06	0.40			0.06	0.03		0.52	0.10		0.10								0.54	0.14			0.26	0.04				0.52	3.06
Eagle Grove	T			1.50	0.15			T		0.50	0.60											1.30			0.15			0.15				4.35
Elkader				0.53	T			0.12		0.02	0.81	0.01		0.11	T							0.73	0.04		0.03	0.21					0.02	2.63
Emmetsburg	1.05			0.87					0.22													1.36			0.04							3.54
Estherville				9.36	0.78			T		0.22	0.15											2.00				T					T	3.51
Glenwood				0.27				0.52			3.48	0.01											0.35								0.30	4.93
Grand Meadow	0.12	T	T		0.61			0.17		0.12	0.44	0.02		0.15	0.03							1.17				0.33						3.18
Greenfield	0.02			0.38		T		1.02	T	T	1.25			T							0.28				0.12	0.10		0.06	0.04		0.32	3.49
Grinnell	0.25	T			0.27			0.13		1.10	0.06			0.12	0.05							0.25	0.93		T	0.25	0.10	0.25				2.85
Grundy Center	0.01	T	T	0.63						0.64	0.11			0.07	0.02							0.74			0.26	0.23						2.71
Hampton	T	T		0.35	0.73			0.04		0.18	0.65											0.76			0.08	0.15						2.94
Hawkeye	T	T					0.56				0.50	0.19		0.15	0.01							1.23	0.12		0.11	0.28	T					3.18
Hopeville	T			0.27	0.04		T	0.66			0.85			T					T			0.01			0.47	0.56		0.08	0.23		0.18	3.35
Hopkinton	T	T	T		0.65			0.03		0.50	0.50			T	T							0.70			0.55	0.20					0.70	3.23
Humboldt					0.73			T		0.28	0.40											0.80				T	0.08					2.29
Independence				0.80				0.01			0.65			0.01	T							0.40				0.35		T			0.30	2.52
Indianola	0.05			1.15	0.80		T	0.34	T		1.10	0.06	T									0.06	0.02		0.11	0.57	0.08	0.44	T	T		4.78
Iowa City	0.05			0.05	0.46			0.06			0.04		T	0.18								T	0.35		9.20	0.20		0.03			0.17	1.79
Iowa Falls				0.72						0.23	0.80											1.35				0.33					0.05	3.48
Jefferson	0.13	0.01	T	0.03	0.32	T		0.40	0.01		2.35	0.03		0.06								1.50	0.40		T	0.14		0.04			0.08	5.50
Keokuk	0.12			0.01	0.13			0.33			0.40				T						0.11		0.22		0.78	1.82	0.04	0.15	T	T	0.22	4.36
Keosauqua	T			T	0.27			0.36			0.17			T	0.15						T	T	0.20		0.92	1.28		0.06	T	T	1.07	4.48
La Crosse (Wis)	0.60	0.07			0.66					0.18	0.08	0.07			T							1.15	0.09	0.05		0.08	0.11					3.14
Larrabee	0.05			1.49				0.29		0.40	0.64											0.45			T	0.10						4.11
Logan				0.41				0.64			1.25											2.16			0.03	0.05				0.19		4.73
Maquoketa	0.09		T		0.38						0 08	0.07		0.05	T																1.15	1.77
Marshalltown	1.00			0.41										0.65								0.20	0.10			0.44					0.30	3.10
Maxon	T			0.90	0.36		T	0.42			0.49			T	T										0.50	0 77		0.13	T	T	0 62	3.38
Mechanicsville	0.05	T	T	0.50	T			0.02			0.04		T	0.12								0.16	0.25		0.24	0.17					1.50	3.15
Monticello	0.24			0.61				0.03			0.52			0.03	0.01						T	0.04	0.11		0.21	0.44	0.21	0.02			0.19	2.57
Mt. Ayr	T			1.53	T		0.03	0.87			1.07										0.05	T			0.73	0.73	0.08	T			T	4.09
Murray					0.41			0.02	0.65	0.01	0.02	0.78			T							T	0.02			0.30	0.37		0.60	0.50	0.66	4.44
Newton	0.04			0.37			T	0.17			1.26			0.05								0.21			0.05	0.21		0.28			0.28	2.92
Omaha (Neb.)	T	T		0.33	T		T	0.37	T	T	1.65											0.96			T	0.04			0.04	0.34	0.10	3.84
Osage	0.60				0.81				0.03	0.40	0.42	0.06		0.02	0.02							0.94	0.35			0.11						3.85
Oskaloosa				0.75				0.25					T		T							0.30				0.75		0.40			0.25	2.70
Ovid								0.59			0.63			0.09								0.05				1.53		0.07	0.09		0.21	3.26
Panama				0.47			0.62			1.61	0.05		0.05	T							1.56	0.76				0.05						5.17
Richland	0.04			0.25			T	T	0.19		0.08			T								0.15		0.28		1.16		0.23			0.86	3.24
Rock Rapids				2.14				T	0.65	0.50	0.20														T						T	4.69
Sac City																						2.00				T				0.25		2.25
Seymour	0.05			0.07	0.09			0.76			0.27												0.02	0.84	0.37		1.13		0.04		0.06	3.70
Sibley				0.93	T			0.47	0.02		0.03											1.05	T			0.06						1.61
Sioux City	T			1.52	0.12		T	0.43	0.01	0.05	0.12											0.80			0.01	0.11			T	T	T	3 17
Storm Lake	0.02			0.68	0.24			0.18			0.32	0.20										1 64			T	0.03					0.10	3.41
Tipton	0.14			0.75	0.01		0.02				0.04			0.29	0.02							0.05	0.43		0.25	0.19		0.02			0.72	2.93
Villisca				0.18	0.12			0.65	0.04		1.34												0.10		0.14	0.26		0.10			0.04	2.96
Vinton	0.16	T	T	0.49				T			0.71			T	T						1.20	0.03			0.40	0.22		T			0.47	2.60
Washington								0.50			0.50			0.25								0.50	0.28		0.22	0.23	0.16	0.50			0.40	1.74
Webster City				0.62	T			T		0.25	1.25											1.00				0.25		0.25				3.62
West Bend	T			0.56				T		31												1.00				0.05						1.92
Williams	0.03	0.01			0.66		T	0.01		0.21	0.21		T									1.24				0.18		0.06			0.06	3.68
Winterset				50				71			87										T	08			16	25		05	04		50	3.16

IOWA PRECIPITATION CHART MAY 1893



MEAN TEMPERATURE MAY 1893



METEOROLOGICAL STATIONS AND OBSERVERS.

From the following, weekly and monthly reports of Meteorological data are received by the Iowa Weather and Crop Service.

Albia	Geo. Price.
Algona	C. D. Pettibone.
Alta	D. E. Hadden.
Amana	Conrad Schadt.
Ames	E. C. Dickinson.
Ames	E. N. Eaton
Ames, (4 miles S. W.)	Isaac Young.
Atlantic	J. W. Love.
Audubon	J. F. Hocker.
Belle Plaine	H. W. Vandike.
Blakeville	James Rodgers.
Blockton	C. W. Thompson.
Bonaparte	Hon. B. R. Vale.
Carroll	Moses Simon.
Cedar Falls	Prof. A. C. Page.
Cedar Rapids	H. D. Olds.
Centerville	Prof. R. E. Keister.
Charles City	J. W. Smith.
Clarinda	A. S. Van Sandt.
Clinton	Luke Roberts.
College Springs	A. A. Berry.
Concord	J. M. Elder.
Corning	John W. Bixby.
Cresco	Gregory Marshall.
Council Bluffs	E. W. Hart.
Davenport	*F. J. Walz.
Delaware	Wm. Ball.
Denison	P. H. Schlumberger.
Des Moines	*Geo. M. Chappel, M. D.
Dubuque	*S. C. Emery.
Eagle Grove	C. A. Schaffter.
Eldora	Prof. C. F. Woodward.
Elkader	Chas. Reinecke.
Emmetsburg	H. Conroy.
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Iowa Falls	J. B. Parmelee.
Jefferson	Dr. Chas. Enfield.
Keokuk	*Fred. Z. Gosewisch.
Keosauqua	Prof. J. H. Landes.
Larrabee	H. B. Strever.
La Crosse, Wis	*W. U. Simons.
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Monticello	Henry D. Smith
Mount Vernon	Prof. A. Collin.
Mt. Ayr.	Hon. Wm. Shriver.
Murray	A. W. Lewis.
Muscatine	J. P. Walton.
Newton	A. Lufkin
Omaha, Neb.	*Geo. E. Hunt.
Ovid	H. C. Miller.
Osage	G. D. Pattingill
Oskaloosa	Jos. Boyd.
Panama	Wm. J. Wicks.
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Richland	Wm. A. Shaffer.
Rock Rapids	W. C. Wyckoff.
Seymour	Mrs. C. A. Conger.
Sibley	H. G. Doolittle.
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Met, 21

THIS NUMBER CONTAINS THE

July Crop Report.

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WEATHER BUREAU.

J. R. Sage,
Des Moines.

MONTHLY REVIEW

OF THE

Iowa Weather and Crop Service.

VOL. IV.—JUNE, 1893.—NO. 6.

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LOCAL FORECAST OFFICIAL,
U. S. WEATHER BUREAU, ASS'T DIRECTOR.

DES MOINES:
G. H. RAGSDALE, STATE PRINTER.
1893.

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U. S. Department of Agriculture---Weather Bureau.

MONTHLY REVIEW

OF THE

IOWA WEATHER AND CROP SERVICE.

VOL. IV.] JUNE, 1893. [No. 6.

IOWA CROP REPORT, JULY, 1893.

SUMMARY OF REPORTS OF OVER 800 CROP CORRESPONDENTS, REPRESENTING EVERY COUNTY IN THE STATE. —AVERAGE CONDITION OF CROPS.

June, 1893, is entitled to rank as an ideal crop month, the weather conditions being well nigh perfect for the cultivation and rapid growth of all crops. The average temperature was slightly above the normal, and there was an abundance of sunshine and rainfall. There was a marked improvement in the condition of corn, hay, oats and most other staples.

The following averages are obtained from correspondents' reports:

Winter wheat, 91; spring wheat, 93; corn, 103; oats, 95; rye, 93; barley, 95; flax, 95; timothy, 95; clover, 92; millet, 96; broom corn, 97; sorghum, 95; Irish potatoes, 103; sweet potatoes, 96; pastures, 101; hay crop, 97; apples, 60; pears, 56; plums, 67; peaches, 74; grapes, 95; blackberries, 86; raspberries, 90; strawberries, 87.

A large number of correspondents state that their estimates of the condition of corn were made by comparison with the crop of 1892, which fell considerably below the average. This accounts for the high rating of that crop. The present condition of corn throughout the State, compared with the normal, is undoubtedly about 99 per cent. The outlook for corn is certainly flattering, and if there are no serious drawbacks it is likely to reach 100 per cent, or a full average crop. The tabulated averages appear on the second page.

EDITORIAL NOTES.

A destructive tornado swept through Cherokee, Buena Vista, Pocahontas and Calhoun counties on the evening of July 6th. A detailed report of that great storm will appear in the July issue of the REVIEW. It may be proper to state in this issue that it was one of the most destructive storms that ever visited Iowa, and when all the details are learned it may be found that it exceeded in violence the Grinnell tornado of June 17, 1882. The loss of life at Pomeroy, and along the entire line of desolation, was very great, the death roll at this writing being above sixty, and several of the wounded victims are not expected to recover. The track of the storm was from one-fourth to one-half mile in width and about sixty miles in length. Such storms are happily infrequent in this State.

***

The Iowa State Fair will begin September 1st, to be held a full week. It will be a great exhibit, and the present indications give assurance of a full average attendance. Iowa will have something to show this year, and it is believed its great exposition will draw many people from all parts of the world to see what the best agricultural state can produce. All Iowa people should take especial pains this year to make the State Fair a notable success.

***

It has been suggested that as the wintry blast is called a "blizzard," the scorching wind of summer should be termed a "sizzard."

***

"The Iowa hog is an educator," says the *Daily Capital*. "He sends the boys to college and increases the number of sweet girl graduates." And that is why Bacon is a favorite author.

***

A Monticello paper reports a singular lightning freak in that town on the 21st of June. A tree near the residence of G. H. George was rent in a manner indicating that the electrical bolt passed upward, and the bark of the tree was thrown against the house with sufficient violence to break several windows and demolish the shutters. The upward current, however, is a phenomenon of not infrequent occurrence.

TABLE SHOWING AVERAGE CONDITION OF CROPS.

COUNTY.	Winter wheat, per cent.	Spring wheat, per cent.	Corn, per cent.	Oats, per cent.	Rye, per cent.	Barley, per cent.	Flax, per cent.	Timothy, per cent.	Clover, per cent.	Millet, per cent.	Broom corn, per cent.	Sorghum, per cent.	Irish potatoes, per cent.	Sweet potatoes, per cent.	Pastures, per cent.	Hay crop, per cent.	Apples, per cent.	Pears, per cent.	Plums, per cent.	Peaches, per cent.	Grapes, per cent.	Blackberries, per cent.	Raspberries, per cent.	Strawberries, per cent.
Adair	92	89	94	82	86	85	78	99	94	91	100	93	104	101	99	98	36	...	46	...	97	83	89	83
Adams	88	75	104	98	95	100	90	98	99	95	90	100	104	97	110	101	36	25	39	...	102	95	101	93
Allamakee	102	100	112	103	107	102	...	110	97	100	...	87	110	...	105	113	75	...	73	...	87	87	102	93
Appanoose	96	100	103	109	87	...	98	100	92	99	96	96	113	99	102	99	55	53	60	100	96	98	100	96
Audubon	102	97	94	87	85	97	87	101	105	95	...	92	98	90	80	104	49	...	54	...	101	95	90	96
Benton	100	100	111	101	100	105	87	100	107	...	100	111	106	99	102	91	78	10	98	...	84	92	98	96
Black Hawk	...	...	104	102	96	100	100	98	95	100	...	94	105	85	107	104	74	...	76	...	91	87	88	95
Boone	...	86	97	88	93	100	89	105	104	96	95	83	101	86	110	106	67	30	79	...	94	84	91	94
Bremer	...	95	103	85	82	90	100	103	107	93	...	100	100	...	107	105	93	...	92	...	87	93	100	97
Buchanan	...	...	107	83	95	...	100	88	95	100	...	103	108	...	108	85	75	...	63	...	92	90	99	97
Buena Vista	...	96	116	90	85	79	98	89	87	89	...	100	112	...	99	86	64	...	90	...	101	78	91	91
Butler	100	89	91	83	87	72	83	97	101	91	...	82	99	77	103	98	62	...	69	...	93	87	94	92
Calhoun	...	96	112	97	95	99	102	95	98	100	...	100	105	90	102	108	51	...	76	...	99	97	99	97
Carroll	86	94	102	100	91	98	98	106	103	102	100	97	106	102	106	107	53	...	80	...	105	80	89	90
Cass	85	93	102	98	97	90	110	102	106	100	100	110	103	120	103	108	68	80	68	...	103	78	95	96
Cedar	90	85	105	92	93	96	100	91	96	79	...	94	108	100	101	91	48	75	81	25	99	73	93	94
Cerro Gordo	...	89	101	86	88	84	92	106	106	92	...	...	88	...	107	108	63	10	47	...	84	62	86	86
Cherokee	...	100	100	108	75	100	100	75	75	100	...	...	100	...	90	90	25	...	100	...	100	100	100	100
Chickasaw	100	100	103	93	102	98	102	95	96	95	...	54	102	...	105	101	62	...	56	...	91	70	90	90
Clarke	95	95	99	102	92	100	100	101	87	96	97	160	110	92	103	98	55	47	61	97	104	103	100	97
Clay	...	89	106	82	97	90	92	95	90	95	97	97	102	100	102	100	46	...	38	...	50	41	72	78
Clayton	95	88	101	89	95	94	...	101	107	95	...	89	99	...	96	101	60	...	55	...	94	67	72	78
Clinton	100	105	110	102	100	100	...	102	100	...	...	...	107	...	105	102	20	...	20	...	105	100	102	100
Crawford	85	97	111	102	99	105	97	99	99	94	100	89	102	80	114	101	48	...	72	...	107	85	79	93
Dallas	80	86	101	84	91	...	90	101	102	97	90	100	103	100	104	104	52	...	52	...	100	86	93	96
Davis	86	...	108	112	86	...	...	96	65	110	...	97	112	100	105	94	49	52	52	106	104	96	96	96
Decatur	101	103	105	100	92	...	87	99	80	92	97	100	115	98	106	93	64	31	63	87	87	98	97	98
Delaware	91	92	107	103	88	100	...	97	86	96	...	99	105	100	104	99	62	...	82	...	91	61	84	103
Des Moines	75	90	107	107	97	...	...	85	62	90	110	105	123	102	97	84	67	82	88	92	95	105	102	102
Dickinson	60	101	112	100	92	103	100	96	99	100	...	103	99	...	106	99	70	85	60	...	...	...	90	97
Dubuque	105	98	101	104	109	101	...	109	103	...	100	100	102	...	104	112	56	...	67	...	92	98	101	97
Emmet	...	92	102	90	95	82	90	102	97	90	...	100	87	...	100	105	85	...	85	...	...	100	100	100
Fayette	100	101	111	101	101	96	96	104	107	92	100	100	106	100	110	108	74	...	85	...	93	91	96	96
Floyd	88	86	102	82	96	89	93	96	100	85	...	95	96	...	97	98	59	...	89	...	88	81	84	92
Franklin	...	101	105	96	99	91	95	98	99	94	...	95	105	...	111	101	58	...	66	...	96	81	92	96
Fremont	77	77	89	91	93	...	...	97	88	99	40	73	107	92	95	96	47	...	58	80	91	92	78	72
Greene	88	93	94	91	84	78	95	101	101	98	...	89	102	88	103	104	38	...	55	...	104	81	82	82
Grundy	...	95	107	90	97	102	97	105	100	100	...	100	107	100	113	108	67	...	52	...	98	67	98	96
Guthrie	98	95	97	93	95	105	93	101	96	98	...	95	103	96	103	100	50	...	60	...	98	85	85	85
Hamilton	...	90	114	86	97	105	100	108	111	102	...	92	113	...	104	107	72	100	91	...	100	100	81	96
Hancock	...	97	101	92	97	90	93	101	101	100	...	103	100	100	106	106	62	...	80	...	94	80	96	96
Hardin	100	95	116	95	99	97	95	103	102	95	97	94	109	95	106	106	71	...	60	...	96	92	96	96
Harrison	97	93	99	87	89	93	...	98	94	96	...	80	96	86	86	100	60	...	61	...	89	80	92	92
Henry	75	75	103	102	85	...	...	80	62	100	90	94	108	101	105	76	45	60	66	69	103	97	85	85
Howard	99	94	107	96	96	97	96	102	105	100	...	90	100	...	107	108	75	...	73	...	94	93	101	97
Humboldt	80	96	111	96	100	97	95	101	105	100	110	100	102	110	104	106	70	...	67	...	93	97	97	97
Ida	105	93	110	105	102	99	...	96	100	100	...	...	100	100	91	97	55	...	100	...	100	75	80	80
Iowa	88	85	100	96	87	90	...	86	85	80	90	92	103	90	97	88	51	...	55	...	85	54	72	72
Jackson	101	100	107	105	97	100	...	98	96	97	...	100	107	100	105	96	67	85	75	...	101	72	83	83
Jasper	98	90	104	96	93	92	...	99	86	94	98	93	98	98	108	97	61	50	67	...	96	87	91	91
Jefferson	81	80	100	108	87	103	...	86	57	94	115	96	108	95	95	82	59	76	68	91	95	86	88	88
Johnston	95	84	99	95	95	87	...	89	85	82	80	83	106	89	100	73	61	50	72	...	98	87	89	89
Jones	...	95	117	110	75	120	...	106	104	100	...	108	110	...	121	106	70	...	83	...	99	72	90	96
Kossuth	...	90	100	85	100	95	100	100	110	80	...	...	100	...	100	110	80	...	90	...	80	95	90	90
Keokuk	99	103	111	104	100	102	...	97	79	93	...	97	115	97	107	106	49	27	55	41	91	87	87	87
Lee	87	100	109	114	98	...	...	77	74	101	100	99	115	99	89	74	51	73	54	69	101	94	96	96
Linn	92	100	109	101	93	95	...	92	89	...	...	107	109	97	97	90	57	50	77	...	97	78	89	89
Louisa	87	120	98	100	100	...	...	98	87	100	...	97	102	93	100	93	50	33	42	10	103	67	80	80
Lucas	99	100	97	99	94	94	100	100	93	101	93	93	108	98	95	101	53	66	66	97	100	90	72	72
Lyon	...	97	104	96	90	96	81	93	100	92	...	...	97	...	87	93	90	...	85	...	...	...	100	100
Madison	94	88	98	94	87	100	100	100	92	101	100	93	105	101	104	101	57	42	42	40	97	96	89	89
Mahaska	97	93	94	99	90	...	...	96	76	...	...	85	100	97	99	92	26	15	46	...	97	71	88	88
Marion	94	91	101	94	93	95	100	99	90	85	93	97	107	94	101	100	60	72	73	88	91	71	88	88
Marshall	95	95	102	95	91	97	91	100	89	100	...	94	101	105	103	98	65	...	100	...	88	76	81	81
Mills	90	87	93	86	89	...	...	102	98	99	100	95	94	87	100	102	49	100	75	100	94	95	90	90
Mitchell	102	96	104	93	101	87	92	107	110	98	92	97	95	...	110	108	70	...	70	...	92	97	100	97
Monona	67	80	100	85	92	80	...	95	72	90	...	...	87	80	85	75	50	...	87	...	90	90	97	97
Monroe	103	100	103	109	102	...	...	105	84	100	90	99	119	97	112	101	68	32	73	82	87	96	91	91
Montgomery	87	94	106	96	99	100	90	104	101	102	...	102	109	101	109	103	71	102	76	100	101	97	107	101
Muscatine	96	80	100	88	83	99	100	84	78	100	...	83	101	93	103	87	39	37	47	36	95	75	67	67
O'Brien	...	100	113	103	97	100	100	105	103	100	...	...	117	...	107	108	97	...	93	...	103	98	90	90
Osceola	...	101	114	104	110	81	95	70	100	98	...	...	105	...	100	97	95	...	56	...	95	98	97	97
Page	92	95	97	97	100	...	...	105	95	...	90	100	95	95	105	105	52	100	47	100	100	95	90	90
Palo Alto	100	98	106	94	85	92	91	96	91	85	100	80	97	100	97	91	73	...	92	...	71	80	84	84
Plymouth	...	90	97	85	85	90	95	90	92	85	95	95	95	...	80	80	100	100	100	...	100	90	90	90
Pocahontas	...	92	110	94	97	99	97	100	99	99	...	98	100	92	103	109	69	...	79	...	105	81	96	96
Polk	98	93	99	88	91	75	...	100	97	99	93	89	99	95	102	96	69	50	73	...	90	85	85	85
Pottawattamie	88	90	89	92	97	92	...	103	99	95	...	87	93	91	105	103	48	50	44	50	94	85	85	85
Poweshiek	100	90	104	93	97	102	...	91	80	100	...	91	103	100	96	90	48	...	69	...	97	68	81	81
Ringgold	84	97	97	96	90	...	80	96	89	90	70	94	106	97	104	96	52	39	55	79	92	93	90	90
Sac	79	93	108	98	94	102	103	97	92	101	...	96	107	95	99	93	52	...	51	...	100	87	85	85
Scott	90	92	100	97	94	87	...	98	98	100	100	97	105	97	101	99	44	52	62	36	89	83	95	95
Shelby	93	91	97	94	87	94	90	101	96	95	...	96	94	97	103	103	41	75	76	...	92	92	92	92
Sioux	40	99	104	91	98	96	97	95	87	92	...	...	96	...	95	93	58	...	88	...	87	105	102	102
Story	...	89	98	93	93	100	89	102	100	94	...	88	103	96	103	104	64	50	66	...	90	87	93	93
Tama	...	98	103	99	92	104	89	96	93	108	...	99	109	97	99	96	68	...	49	...	115	103	103	103
Taylor	88	95	104	102	92	...	...	99	95	100	...	104	107	102	108	101	48	66	60	77	99	90	92	92
Union	95	96	96	91	98	...	...	94	89	100	...	93	110	102	103	95	55	96	54	...	97	86	82	82
Van Buren	79	87	103	106	93	...	...	93	63	102	80	98	119	97	106	85	50	50	90	86	108	95	90	90
Wapello	89	100	107	108	96	...	...	89	71	85	...	100	105	100	102	90	38	35	57	125	90	84	77	77
Warren	89	94	101	96	93	100	...	100	90	98	97	89	90	96	104	99	64	67	60	60	99	96	88	88
Washington	85	89	111	104	94	100	...	89	72	100	97	108	121	93	101	87	65	50	65	57	97	88	80	80
Wayne	94	93	99	100	95	100	83	97	79	93	89	100	105	96	102	94	55	50	59	63	97	86	95	95
Webster	...	92	105	100	97	96	95	93	100	95	100	105	102	110	97	98	88	...	83	...	100	95	100	100
Winnebago	...	100	120	100	...	110	100	110	130	100	...	100	120	...	120	120	...	...	...	...	...	100	110	110
Winneshiek	98	99	108	101	97	102	97	100	105	...	100	96	100	...	107	106	76	...	93	...	91	85	89	89
Woodbury	97	97	105	97	97	107	60	95	107	88	...	...	107	90	91	93	42	...	72	...	90	76	72	72
Worth	74	94	103	88	92	94	99	105	106	94	...	...	94	...	109	107	36	...	76	...	100	82	92	92
Wright	...	92	104	87	87	87	97	102	105	95	...	92	102	100	108	110	69	...	77	...	88	84	92	105
Average per cent	91	93	103	95	93	95	95	95	93	96	97	95	103	96	101	97	60	56	67	74	95	86	90	87

EDITORIAL NOTES

A scientific course leads the student out into the fields and causes him to study nature and observe her methods. A literary course necessitates a close study of books. The library is the workshop of the literary student, while the universe is the field of the scientist.

***

During a thunder storm at Winter Park, Fla., a number of sunfish, two to four inches long, fell with the rain. It is supposed they were taken up by a waterspout from Lake Virginia, about a mile distant.

***

Mr. A. G. Chase, of Leavenworth, Kansas, writing to the *American Agriculturist*, says: "With good land and a favorable season, corn can now be raised for less than ten cents per bushel in Kansas, Missouri or Iowa. Better horses, improved implements and more skillful cultivation have increased the average yield and lessened the cost of cultivation and preparation." We suspect that the cost of raising corn depends much upon the good sense of the farmer. The poorer the yield the higher the relative cost of its production.

***

Don't growl about the weather, but jes' take it as it comes.
When the sky is beamin' brightly, or the thunder beats its drums!
Stop complainin' 'cos it's rainin', but be thankful fer the drops
As they sprinkle, "tinkle, tinkle," on the dry and thirsty crops!

Don't growl about the weather, when the birds is singin' sweet,
An' the daisies like a white cloud are a-foamin at your feet!
Don't ever growl at nothin', on the earth, or up above;
It's the light that makes the shadders, an' the light is sweet with love!

—*F. L. Stanton in Atlanta Constitution.*

Clover seed sown this season came up in fine shape and the fields are generally very promising. Many reports are received of the winter-killing of clover in meadows. In many instances we suspect the clover plant died a natural death, after having been cut early and allowed to go to seed. Clover is a biennial plant, and the only way to keep it longer is to cut it two or three times during the season, never allowing it to ripen its seed.

***

The value of tornado caves was thoroughly demonstrated at Pomeroy during the late storm. There are a half dozen such places of resort in the area of total destruction, and in every instance they afforded absolute protection to all who crowded into them. One little cave saved seventeen precious lives. If every family had been provided with a similar place of refuge the entire population might have been saved, for the warning was ample.

GOVERNMENT CROP REPORT.

WASHINGTON, July 10.—July returns to the department of agriculture show the following averages of condition: Corn, 93.2; winter wheat, 77.7; spring wheat, 74.1; oats, 88.8; rye, 85.3; barley, 88.8; potatoes, 94.8, and tobacco, 93.

The preliminary acreage of corn reported is 103.3. As compared with the acreage harvested last year it is an increase of something over two million acres. The averages in the principal states are: Illinois, 105; Iowa, 105; Missouri, 103; Kansas, 110, and Nebraska, 112. The average condition of corn is 93.2, against 91.1 last July. The averages in the principal states are: Illinois, 92; Iowa, 98; Missouri, 92; Kansas, 93, and Nebraska, 94.

The condition of winter wheat is 77.7, against 75.5 last month, and 89.6 in July, 1892. The principal state averages are: Michigan, 79; Illinois, 56; Missouri, 77; Kansas, 46; California, 88, and Oregon, 96.

The condition of spring wheat is 74.1, against 90.9 in July, 1892. Last month it was 86.4. The state averages are: Iowa, 95; Nebraska, 68; South Dakota, 89; North Dakota, 73, and Washington, 91.

The condition of wheat July 1, 1893, was 76.6, and on June 1st it was 76.8.

The condition of oats remains about the same as last month, being 88.8 as against 88.9 June 1st.

July returns show a slight advance in the condition of rye from 84.6 on June 1st to 85.3 this month. Winter rye stands at 83.8, and spring rye at 89, the combined average, as stated above, being 85.3.

The condition of barley has changed but little during the month. The average is 88.8, against 88.3 on the 1st of June.

The acreage devoted to potatoes this year is 101.1 per cent of that of last year. The condition is a little higher than last year. There are reports of injury from Colorado beetles, especially in the central west.

The tobacco acreage is returned at 98.6 per cent of the area devoted to that crop last year. The condition stands at 93. The condition of clover is 92.6; timothy, 89.8; pasture, 94.

THE EFFECT OF FOOD UPON THE COMPOSITION OF BUTTER.

Practical dairymen, who produce a high grade of butter, lay great stress upon the quality of food with which their cows are fed. Chemists, who have had much to do in the examination of butter for adulterants, have observed that the samples from one region have steadily varied in their composition from those of another region, where different practice prevailed in feeding. These facts have led to many experiments, both in Europe and America, to find out the specific action of different foods upon the composition of butter.

This product of the diary is composed of fat, water, salt and curd; and of these, the cow is responsible for only the fat and the curd. The former constitutes about eighty-five per cent and the latter barely one per cent of the butter; therefore chemical examinations for variations due to food have been confined wholly to the fat. Butter fat differs from the fat deposited in the body of the animal by having from five to seven per cent of volatile fatty acids, and only eighty-seven to ninety per cent of insoluble, fatty acids, while tallow has ninety-five per cent of the latter and less than one-half of one per cent of the former. The volatile acids give butter fat its characteristic flavor, and also cause it to be softer than tallow. Butter fat also differs from tallow in having less oleic acid among its insoluble acids. These two characteristics of butter fat have been studied more than any other of its properties, because of their relations to adul-

terations, and the studies of food effects have so far been confined to the same lines.

In the course of investigations, it has been found that in general, the widest variations in volatile acids and oleic acid are due to the progress of lactation; the latter increases and the former decrease as the period advances. Individual cows also vary widely from one another in the composition of their butter fat, but with regard to the breeds no definite conclusions can be made.

The effect of food is greater upon the oleic acid than upon the volatile acids, and, in nearly all cases variations in this constituent of the fat have been closely related to variations in the firmness of the butter. This is to be expected, as oleic acid is an oily liquid at summer temperature, and the butter is softer or harder as this acid is present in greater or less amount.

Many of the foods have been tried in such limited amounts that it is unsafe to draw conclusions, therefore only such foods will be mentioned here as have been used in repeated trials. The most notable effect has been produced by cotton-seed and cotton-seed cake. Whenever it has been fed, the volatile acids and oleic acid have been depressed below the average; the butter is deficient in flavor and often too hard to be easily cut with a knife.

In strong contrast to this action of cotton-seed, is the effect of gluten-meal, a by-product from the manufacture of corn-starch. This food is especially effective in raising the oleic acid above the average, and also produces a butter fat high in volatile acids. The butter from this food is frequently too soft for an ideal product. Corn-meal, however, has always produced a butter fat low in oleic acid, but has shown no action on the volatile acids. Clover, dry or green, has produced fat high in volatile acids, and with oleic acid slightly above the average. The same is also true of spring pasturage. Early cut straw generally produces a fat with volatile acids and oleic acid below the average.

The action of clover and pasturage in increasing the volatile acids, and that of corn in lowering the oleic acid, explains the practice of the makers of first-class butter, who rely upon these foods to produce a good flavor and firm grain.—*F. M. Morse, in Science.*

EXPLANATION OF CERTAIN IRREGULARITIES ENCOUNTERED IN WORKING COAL SEAMS IN IOWA.

BY HARRY FOSTER BAIN.

IOWA GEOLOGICAL SURVEY.

The present distribution of the coal beds of Iowa has been largely influenced by the erosive action of running water. This erosion took place at two very distinct and widely separated periods of time. The one was in very ancient times, before the Coal Measures of this state were laid down. The other dates back only to a comparatively recent time, long after the Coal Measures rocks had been deposited.

Of the two cycles of land degradation the effects of the latter are by far more familiar and easily recognized. They are to be seen partly in the hills and valleys of the present time and partly in a series of hills and vales now buried beneath the thick mantle of drift which everywhere spreads out over the state. These ancient drainage courses have in many places cut away large portions of valuable coal beds. In certain sections this fact becomes an important factor among those limiting the availability of coal supply. Since, however, its effects can, in the majority of instances, be deciphered from the existing land relief, the limits which it has set to profitable mining are not so serious as those of the earlier period.

The other and earlier cycle of erosion which has just been referred to as antedating the laying down of the coal bearing rocks was immediately before the coal epoch—during the closing episodes of the Lower Carboniferous—soon after the St. Louis rocks were deposited.

The St. Louis epoch was represented in Iowa by a period of subsidence during which the shore line of the ancient sea swept rapidly northward into southern Minnesota. The lower beds of this formation are usually made up of a characteristic brecciated limestone; while above, the layers are more evenly bedded. Marls containing abundant and characteristic fossils rest on the limestone. At the close of the epoch there was a period of elevation and the waters retreated southward leaving Iowa an area of dry land. It was during this time that rivers and brooks cut and carved much of the old St. Louis surface into slopes, not greatly different from those of the present surface. Some of the streams of that time corraded their channels in the hard limestone to a depth of probably a hundred feet or more. The hills which rose on either side had in many cases quite precipitous slopes.

It was upon such a floor as this that the Coal Measure deposits were laid down; and it is largely due to these irregularities in this old surface that the distribution of the coal in certain places in this state is so irregular. The character of this ancient land surface has not only acted as a limiting factor, but has also conditioned the deposition of the beds. Along a modern sea coast the character and position of the rocks now being formed are largely dependent upon the character of the adjacent shore. A bold rocky headland will afford favorable conditions for the formation of a conglomerate; a low retreating shore line for clay or sand beds; and a river or overflowed low land often gives rise to swamp deposits. All these factors operated in the same manner along the borders of the Carboniferous sea and the relation between the St. Louis limestone and the Coal Measure deposits are shown in characters of the different layers.

Along the eastern margin of the coal field where the productive beds thin out rapidly in passing eastward from the Des Moines river, the relations of the two seams are of considerable economic as well as scientific interest.

The general relations existing between the two formations have been noted at many times. The fact of an unconformity was recognized long ago and discussed in a general way by Prof. James Hall and Dr. C. A. White. Detailed work has been done more recently by Dr. Charles R. Keyes, and the relations are now comparatively well understood. They vary considerably in different parts

the state, but the general facts may be summarized as follows:

(1) The Lower Coal Measures repose unconformably upon the St. Louis limestone as shown by Hall.

(2) The time gap between the two is represented by the deposits of Kaskaskia, which are found extensively developed farther to the southward.

(3) During the Kaskaskia times Iowa was a land surface and became deeply carved into hills and valleys.

(4) As depression took place these valleys became filled with coal deposits; leaving the hills for a time as islands surrounded by Coal Measure swamps.

(5) Eventually these hill tops themselves became covered and thus the old St. Louis surface became completely buried.

(6) The directions of the present water courses are entirely independent of the old land surface; for the present streams sometimes cut across ancient river valleys now occupied by sandstones, coals, and shales, sometimes through old hilltops and limestone.

Considering first the geological formations in Mahaska county, which may be taken as a typical example of all those counties along the eastern border of the Iowa coal field, in connection with the proposition just stated, it is found by a careful examination of the natural outcrops and road cuttings, as well as by borings, that the statements just made are fully substantiated. A somewhat generalized cross-section of the county from northeast to southwest shows clearly the arrangement and relations of the different formations, as recently determined, with considerable detail. (Figure 1.)

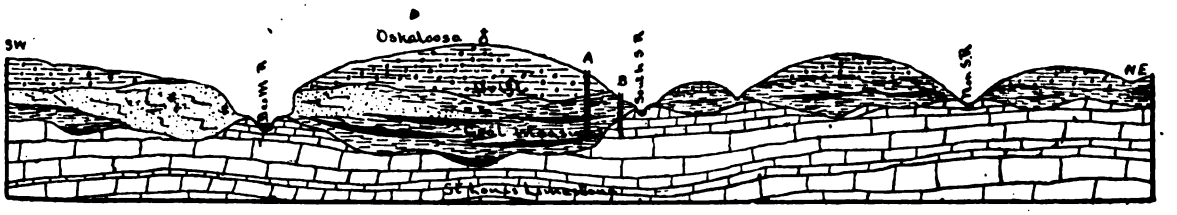


Figure 1.

The occurrence of the Lower Carboniferous limestone in Mahaska county has been known for more than forty years. Owen mentioned its occurrence on the Des Moines at several points. Worthen recognized it as occurring in the extreme eastern portion of the county along the borders of the Skunk river. White also makes mention of several localities in which the Lower Carboniferous is found in the region under consideration. The observations lately made in Mahaska and neighboring counties show that the St. Louis limestone has a much wider distribution over this region than has heretofore been supposed. It is now known to be exposed along the borders of the three principal streams—the Des Moines, North Skunk and South Skunk rivers—extending entirely across the county. The formation has been traced along the lines mentioned, the exposures being numerous as well as favorably situated. The limestone was found to be well developed in a number of points fifteen to twenty miles beyond those heretofore reported, thus extending the previously known limits of the Lower Carboniferous to the extreme northwestern corner of the county. The areal distribution of the St. Louis limestone in Mahaska and neighboring counties is shown in the accompaning sketch map. (Figure 2.)

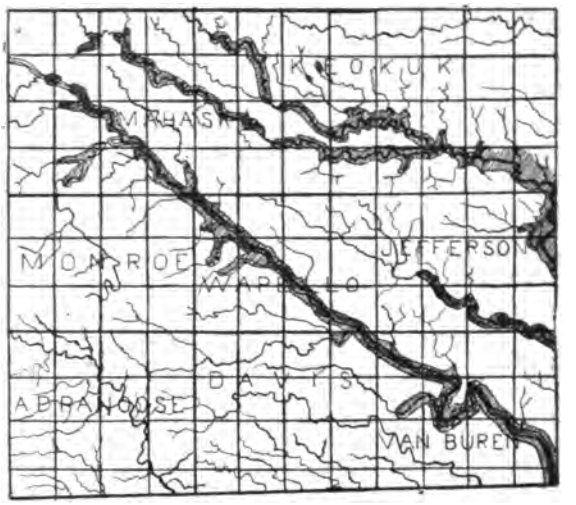


Figure 2.

In passing down the North Skunk the Lower Carboniferous beds are first well developed in this county, about four miles from the north county line. Down to this point only sandstones and shales of the Coal Measures are exposed. Near the point mentioned, at a place called Union Mills, the limestone is quarried for local use. Below here limerock outcrops at frequent intervals. In some places it is covered only by drift; in others it is overlaid by thirty or more feet of Coal Measure strata.

Near the eastern border of the same county the limestone, which is well exposed above the water level of the North Skunk, is abruptly replaced by sandstone, while some distance further down the stream the limerock again comes into view suddenly. The stratigraphic relations of the sandstone appear to indicate with but little doubt that it fills an old gorge or eroded depression in the limestone. Another similar outcrop is shown in the adjoining township on the South Skunk, where a sandstone bluff thirty to one hundred feet high and at least three-fourths of a mile long intervenes in like manner between two outcrops of limestone. At certain places the bluff just referred to exhibits cross bedding on a large scale. This is seen again at the point where the C., R. I. & P. Railroad

crosses the South Skunk, in the northwestern part of the same township. Still another noteworthy occurrence is that on the Des Moines river near the western margin of the county, just below the mouth of Cedar creek. At this locality, which is known locally as "The Bluffs," is a massive sandstone forming a precipitous escarpment rising to a height of one hundred feet or more and extending a distance of nearly two miles. Both above and below, the limestone is found along the river. Other, though perhaps less prominent, examples of the same phenomena have also been observed in other portions of the county.

On the South Skunk the St. Louis limestone extends across the county to within a short distance of the northwestern corner. At Peoria it is quarried for local use. Near this point the limerock disappears beneath the water level for two or three miles, reappearing again in Marion county, the intervening area being occupied by sandstone.

While Mahaska is one of the most important coal counties of the state, it will be seen by referring to the general section (Figure 1), that the coal measures are comparatively thin. The greatest thickness of the formation is probably less than one hundred and fifty feet. From this maximum limit it varies down to nothing. This varying difference is not due in any way to the irregularities of the present land surface, for it could exist even if the latter were perfectly level. It is dependent almost wholly upon the unevenness of the floor below, upon which the marginal sediments of the Coal Measures were laid down.

The relations existing between the Coal Measures and St. Louis limestone, as outlined above in Mahaska county, are found to hold equally good for the other counties of this section, and the description could be duplicated from any one or all of them.

The general distribution of the two formations in this region is shown on the accompanying sketch map. (Figure 2). In passing down the Skunk River in Keokuk county, the alterations of limestone and sandstone are found much as they are in Mahaska county. At Sigourney the St. Louis limestone is found at a depth of 98 feet beneath the surface. At What Cheer, the limestone is exposed and quarried along Rock creek two miles east, and is again exposed along North Skunk about six miles west. It was also quarried, some years ago, along Coal creek, just south of town. Yet a boring scarcely a mile away showed it to be more than 220 feet below the surface, and coal mines are operating on each side only a short distance away. In one instance the limestone was encountered in driving a horizontal entry. These relations are well illustrated in the following diagrammatic sections. (Figure 3)

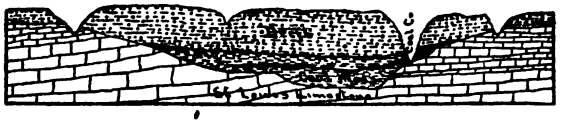


Figure 3.

In Jefferson county the larger streams have generally cut their valleys down to and into the limestone, while above in the hills the Coal Measure deposits are exposed. A good example of the contact between the two sets of beds may be seen about three miles south of Fairfield, on Cedar creek. At this point a thin layer of impure coal is seen a few feet above the St. Louis limestone which contains characteristic fossils.

In Wapello county the limestone is exposed along the Des Moines and for a short distance up the tributary streams. At one point on North Avery a bed of coal is found within three feet of the limestone. In Van Buren county the St. Louis limestone is exposed in many places along the Des Moines river and its tributaries, particularly from the western corner of the county to Bentonsport, at which place the Keokuk limestone rises from beneath the water level of the Des Moines river.

A study of the distribution of limestone as shown on the accompanying sketch map (Figure 2), and of its relations to the overflowing strata as shown in the sections, (Figures 1 and 5), will show a great irregularity in the distribution of the rocks of the region. It will be readily seen that this is due more to the irregularity of the Coal Measure floor than any other agency. This fact explains how a coal seam may lie a hundred feet or more below the present level of an outcrop of Lower Carboniferous only a short distance away, and how, without taking into consideration the fact just described, regarding the uneven character of the Coal Measure floor, it might be readily believed that the limestone was at a higher horizon than the coal; and that therefore the former was overlaid by the latter. This may be made more clear perhaps, by examining figure 1. If a boring were made at A, coal would be found at a depth considerably below that at which the limestone would be found at B. Therefore, it would be inferred, naturally, that at B the coal encountered at A might be reached by boring down through the limestone; whereas geologically, the limestone is beneath the coal-bearing rocks. As a matter of fact, prospecting for coal has been carried on in a number of places upon exactly such erroneous inferences as has been mentioned. It is hardly necessary to say that the attempts resulted in failures.

In all search for coal in this region, it must be remembered that while the coal was laid down long after the limestone, appearances may be so deceptive as to seem to indicate that the limestone is at a higher level than the coal. In all such cases a careful consideration of the local conditions is of prime importance in order to bring our true relationship of the different formations.

CROP STATISTICS OF POWESHIEK COUNTY.

(From the Brooklyn Chronicle.)

The magazine and newspaper of to-day fairly bristle with statistics. The age demands accuracy and many schemes are resorted to in order to secure it. The modern scientist observes minute details almost wholly. One devotes his life to the study of a few insignificant bugs with unpronounceable names; another watches the weather and carefully records the changes—they are both working to meet the demand for accurate information.

In the same way the advance of the world in industrial invention and social science has made statistical information in those lines a necessity, and the millions that are annually spent in all enlightened countries add greatly to industrial progress and human happiness. The profit of the tradesman and the thrift of the farmer are greatly affected by the accuracy of the information upon which business operations of each are based. The intelligent farmer knows that misrepresentation of crop prospects in the interest of higher prices meets with but temporary and partial success, followed by revulsion and disaster. As waters find its level, so prices tend to the equilibrium found under the law of supply and demand. The truth in its plainest garb subserves best the truest interests of the consumer and producer, though not the pecuniary advantage of the sharks who would thrive by the plunder of honest labor. The National census coming but once in ten years is more a series of minor estimates than an actual enumeration, so far as crops are concerned; the defective memory of the farmer as to the crops of the previous year is the best dependence of the census taker, when he is too conscientious to draw upon his imagination or take second-hand estimates of the neighbors. Estimates are being continually made while crops are growing and published as a guide to trade by those interested in speculation. Iowa is among the first of the states to attempt to furnish accurate information regarding quantities produced of the principal crops. The State is pre-eminent in agriculture, and our lawmakers saw that a few facts and figures would be a substantial advertisement.

It was accordingly ordered that on odd numbered years, the township assessors should be required to collect statistics of farm products and live stock. Auditor Buxton has just completed the tabulation of these reports for the county, and *The Chronicle* is indebted to him for the following summary. As you consider these figures, remember that last year was considered unfavorable for farm products. The winter of 1891-92 was too warm and mild, with too little snow for sleighing and so much rain that the ground was kept wet and soggy when it should have been frozen. The spring was simply the winter long drawn out—cold, cloudy, wet succeeded by a dry summer. The fruit crop was almost a failure, but Poweshiek was no exception in this respect. In fact Poweshiek is always in the push and when the State auditor's report appears we predict that it will loom up like a boat house in a fog. The tabulated statement presented herewith needs no apology or explanation, they speak for themselves.

PRODUCT.	No. of Acres.	Total Yield.	Average per Acre.
Winter Wheat	828	13,527 bu	16⅓
Spring Wheat	761	9,132 "	12
Corn	86,096	3,185,515 "	37
Oats	56,650	1,512,033 "	26⅔
Barley	115	1,955 "	17
Rye	601	7,212 "	12
Buckwheat	133	1,197 "	9
Timothy Seed	1,351	6,755 "	5
Clover Seed	197	221 "	1⅛
Potatoes	1,004	58,232 "	58
Sweet Potatoes	2	176 "	88
Sorghum	80	5,480 gals	68½
Timothy Hay	42,848	73,484 tons	1¾
Clover Hay	4,709	82,40 "	1¾
Hungarian Grass	73	97 "	1⅓
Millet	340	640 "	2
Prairie Hay	3,707	7,414 "	2
Pasture	143,588		
Artificial Groves	1,109		
Natural Groves	9,715		
Apples	1,597	6,184 bu	
Grapes		109,205 "	
Raspberries		730 "	
Strawberries		597 "	
Other Small Fruits		842 "	

Improved land 343,606 acres.

Unimproved land 21,159 acres.

LIVE STOCK.

Horses	16,678
Thoroughbred horses	64
Mules	441
Cattle	49,452
Thoroughbred Cattle	574
Sheep	5,389
Thoroughbred sheep	71
Swine	60,346
Bees (stands)	1,446
Italian Bees (stands)	675
Honey Product	41,043

JUNE WEATHER REPORT.

June was an ideal month, favorable to all forms of life. The monthly mean temperature, 71.2 degrees, was about 2 degrees above the normal for the State. The average rainfall, 3.91 inches, was about 1.00 inch below the normal amount, but it was fairly well distributed and gave ample moisture to nearly all parts of the State.

The elements were generally propitious during the month, and less than the usual June quota of severe local storms have been reported. On the evening of the 10th a wind storm, accompanied by hail, visited the country three miles west of Dunlap, touching portions of Harrison and Crawford counties. Several buildings were injured, and a barn belonging to Carl Remley was destroyed and some stock killed.

In the northwestern part of Guthrie county considerable damage to crops was done by hail on the 23d. It is described as a destructive storm, from three to six miles wide, and the hail from four to six inches deep. Corn and small grain in its pathway were completely ruined. A hail storm of small extent is reported from Defiance, Shelby county, on the 21st of June.

The following table gives, as a basis of comparison, the mean temperature and total rainfall for the month of June, at the stations named, for the years from 1872 to 1893, inclusive:

YEARS.	MEAN TEMPERATURE, DEGREES.						PRECIPITATION, INCHES.					
	Des Moines.	Davenport.	Dubuque.	Keokuk.	Omaha.	Sioux City.	Des Moines.	Davenport.	Dubuque.	Keokuk.	Omaha.	Sioux City.
1872	....	72	....	75	73	....	....	3.78	....	5.81	3.91	....
1873	....	78	....	78	74	....	....	2.16	....	1.21	5.86	....
1874	....	73	72	76	73	....	....	5.37	3.50	4.01	6.92	....
1875	....	68	68	71	71	....	....	4.91	4.75	3.33	10.95	....
1876	....	69	69	70	68	....	....	4.25	7.88	6.73	3.47	....
1877	....	69	68	72	69	....	....	5.80	6.75	7.82	8.36	....
1878	....	68	67	70	67	....	....	4.36	4.35	3.93	8.48	....
1879	70	70	69	71	73	....	6.69	4.57	4.99	2.63	4.09	....

YEARS.	MEAN TEMPERATURE, DEGREES.						PRECIPITATION, INCHES.					
	Des Moines.	Davenport.	Dubuque.	Keokuk.	Omaha.	Sioux City.	Des Moines.	Davenport.	Dubuque.	Keokuk.	Omaha.	Sioux City.
1880	72	72	71	74	73	...	4.11	7.20	6.02	3.06	3.14	.....
1881	71	70	68	72	75	...	15.70	7.94	7.56	8.70	5.56	.....
1882	68	69	67	71	71	....	12.16	8.43	6.29	9.45	12 05	.....
1883	68	68	68	69	69	....	7.75	4.38	5.34	5.88	12.70	.....
1884	70	70	69	71	72	..	3.84	3.07	4.89	4.03	6.11	.....
1885	69	68	67	70	71	...	5.03	2.08	6 16	6.97	2.67	.....
1886	71	70	68	71	70	....	1.21	.49	.71	2.86	1.50	.....
1887	72	73	72	73	72	...	2.25	1.66	1 32	1.55	4.56	.....
1888	69	70	69	71	70	....	2.32	3.86	5.28	5.42	3.86	.....
1889	67	67	66	68	69	...	4.39	5.59	3.87	2.97	5.44	.....
1890	73	74	74	76	74	72	4.91	4.51	9.59	3.41	5.04	3.61
1891	69	71	70	72	69	68	5.60	3.56	2.34	3.66	6.66	7.62
1892	69	70	68	73	71	69	3.41	10.79	14.16	2.65	1.57	1.50
1893	71	72	72	73	73	72	4.69	3.82	5.49	2.37	7.11	1.63
Means	70	70	69	71	....	70	5.61	4.40	5.56	4.99	5.76	3.59

SUMMARY OF WEATHER CONDITIONS.

BAROMETER: Mean pressure for the month, 29 93. Highest observed, 30.28, at Keokuk, on the 7th; lowest observed, 29.54, at Davenport, on the 1st. Range for the State, 0.74 inches.

TEMPERATURE: Monthly mean 71.2, determined from 67 Volunteer Observers' reports. Highest monthly 76.5, at Washington; lowest monthly mean 68.2, at Cresco. The highest temperature reported was 100, at Richland and Washington, on the 12th and 19th. The lowest temperature reported was 40, at Atlantic and Sibley, on the 5th and 6th. Average daily maximum, 82.3; average daily minimum, 60.3; average monthly maximum, 92.1; average monthly minimum, 49.2; greatest monthly local range 55, at Atlantic; least monthly range 31, at Ft. Madison; range for the entire State, 60.

PRECIPITATION: Average for the State, 3 91 inches, determined from 69 Volunteer Observers' reports. The greatest amount reported, 7.56 inches, at Atlantic; the least amount reported, 1.36 inches, at Rock Rapids. Average number of days on which .01 or more rain fell, 7 9. Average number of cloudy days, 4.9; partly cloudy days, 10.7; clear days, 14 6.

Solar halos—Ames, 17th; Blakeville, 6th.

Lunar halo—Ames, 25th.

Thunderstorms occurred quite generally throughout the State on the 3d, 4th, 9th, 10th, 14th, 21st, 23d and 30th.

High winds—Audubon, 23d; Charles City, 25th; Keosauqua, 21st; Panama, 7th.

Hailstorms—Cresco, 14th; Shelby, 21st; Denison, 23d; Keosauqua, 23d; Guthrie, 23d.

ATMOSPHERIC PRESSURE.

STATIONS.	Mean reduced barometer.	EXTREMES.			
		Highest barometer	Date.	Lowest barometer	Date.
Cresco	.....	30 20	7	29.73	1
Clarinda	29.94	30.24	6	29.70	1
Cedar Rapids	29.92	30.20	7	29.64	1
Davenport	29.92	30.23	7	29.54	1
Des Moines	29.94	30.21	7	29.66	1
Dubuque	29.94	30.20	7	29.62	1
Keokuk	29.95	30 28	7	29.53	1
Omaha, Neb	29.93	30.25	6	29.70	1
Sioux City	29.88	30.20	6	29.65	1
Means	29.93	30.28	7	29.54	1

WIND MOVEMENT.

STATIONS.	Miles.	Maximum velocity.	Direction.	Date.
Davenport	5,500	36	SW	21
Des Moines	4,728	33	S	11
Dubuque	3,250	25	W	8
Keokuk	3,884	36	NW	21
La Crosse, Wis	4,822	28	S	8
Omaha, Neb	5,125	30	S	8
Sioux City	7,910	48	NW	21

OBSERVERS' NOTES.

Clinton, DR. LUKE ROBERTS:—There were no meteorological excesses chargeableto June, 1893. All conditions were favorable to the growth of agricultural and horticultural products. This was very gratifying, as the season was some days later at the commencement of the month. Corn, oats, potatoes, meadow grass and pastures, as well as small fruits, flourished almost without a precedent, so that at the close of the month they were found up to an average in their race toward maturity.

The mean temperature for the month was 71.2°, being 2.1° above normal. The maximum temperature was 92°; this was 3.9° below normal, while the minimum was 4.5° above normal, being 48°. Only one June during the last 12 years furnished a higher minimum, that was in 1892, 51°. The lowest June minimum for the last 12 years was 33°, in 1892. The coldest day was the first, being 59° mean temperature, an excess of 4° above a mean of coldest June days. The warmest day was the 19th, the mean being 80.7°; this was also above the average warmest June days.

The number of storms was ten, one less than a June average. All storms were light. The greatest precipita-

tion was on the 10th, when .77 of an inch fell from 6:10 to 11 A. M., accompanied with some thunder and lightning. A light storm with much thunder prevailed on the 20th.

On the 21st a lively wind storm visited this section from 7:30 to 9 P. M. The wind attained a velocity of 32 miles an hour, breaking trees, etc., and beating down rank grass and oats. A little rain fell after the wind had subsided to about 19 miles an hour.

The per cent of cloudiness was low and the number of clear days was in excess of a June normal by 7.4 days.

The prevailing direction of the wind was southeast, and yet it was more nearly equal from all points of the compass than a monthly average. The total movement of wind was 2,660 miles. This was a little below a June average.

The total rainfall for the month was 3.22 inches. This was 1.85 inches below a June average.

Northern lights were seen between 10 and 11 o'clock on the evening of the 17th, also on the morning of the 23d, from 1 to 2. The rays extended from the northern to the southern horizon, traversing the milky way, and though not bright was interesting to look upon from its unusual form.

Bonaparte, B. R. VALE:—Since the first week the month was favorable and properly improved in agriculture; no very serious storms.

Cedar Rapids, H. D. OLDS:—The mean temperature for June has been two degrees above the normal. Rainfall near the average for past ten years. No damage by storms during the month—several have passed at a distance. Crops of all kinds are looking fine.

College Springs, A. A. BERRY:—A very satisfactory month, and crops have made good growth and promises a bountiful harvest; better than last year, except apples, which are about the same. Hay an average. Pasture above an average. All stock looking well. Fall wheat a little less than last. Corn ten days earlier than last year and very clean.

METEOROLOGICAL DATA FOR JUNE, 1893.

STATIONS.	TEMPERATURE OF THE AIR (IN DEGREES FAHRENHEIT).								PRECIPITATION IN INCHES.			Prevailing direction of wind.	No. of cloudless days.	No. of partly cloudy days.	No. of cloudy days.	No. of rainy days. (.01 inch or more).	No. of hail-storms.	No. of thunder-storms.
	Monthly mean.	EXTREMES. Mean maximum.	Mean minimum.	Maximum.	Date.	Minimum.	Date.	Monthly range.	Monthly.	Total monthly snowfall.	Depth of unmelted snow at end of month.							
Algona	73.2			*91	13	*56	6	35	1.69			SW	18	12		5		1
Ames (W. R. Cooper)	69.5	81.0	58.3	90	12	47	6	43	4.90			SE	14	10	6	11		1
Ames (four miles southwest of)	72.7			*94	13	*50	2	44	4.70			SE				11		
Amana	71.2	82.6	59.9	93	12	48	7	45	4.28			S	16	9	5	8		2
Atlantic	71.7	85.8	57.5	95	17	40	6	55	7.56			S	12	12	6	7		3
Audubon	71.6	84.6	58.6	92	13	44	6	48	4.93			SW	2	19	9	7		1
Belle Plaine	71.0	82.5	59.6	91	12	47	6	44	3.43			SE	13	9	8	9		
Blakeville	71.8			93	17	54	6	49	3.30			SE	9	13	8	6		
Bonaparte	71.9	83.7	60.1	95	12	49	6	46	4.27			SE				8		
Carroll	72.2	83.0	61.4	92	19	44	6	48	3.64				21	4	5	8		
Cedar Falls	70.2	84.1	56.2	91	19	47	6	44	3.15			SW	12	12	6	7		
Cedar Rapids	72.2	81.4	63.1	90	13	52	6	38	4.89			S	21	7	2	9		
Centerville	72.2	85.2	61.2	94	13	48	6	46	3.05			S	17	11	2	6		2
Charles City	72.0	82.9	61.0	90	12	50	6	40	2.71			NW				11		1
Clarinda	70.5	79.7	61.4	88	19	52	6	36	4.12			SE	10	14	6	5		
Clinton	71.8	82.8	60.9	92	19	51	6	41	3.22			SE	13	10	7	10		
College Springs	70.2			*92	21	*49	5	43	4.37			S	18	7	6	6		
Corning	69.4	79.6	59.2	87	13	47	6	40	3.82			SE	17	5	8	6		3
Cresco	68.2	78.3	58.0	89	13	45	6	44	4.14			SW	15	12	3	7		
Davenport	72.0	81.0	62.9	93	12	51	6	42	3.82			E	10	11	9	12		9
Delaware	69.9			*92	12	*55	1	37	4.29			SW	14	11	5	9		
Denison	71.0		59.7			52	1		3.05									
Des Moines	71.4	81.0	61.7	90	13	47	6	43	4.69			SE	12	7	11	13		10
Dubuque	72.0	80.6	62.3	92	19	52	6	40	5.49			SE	9	12	9	8		
Eagle Grove	70.4								5.90			S	23	3	4	6		
Elkader	70.6	83.2	57.9	94	12	46	7	48	2.92			S	19	8	3	9		1
Emmetsburg	69.6	82.0	57.3	93	12	44	5	39	1.73			S	19	8	3	4		
Ft. Madison	75.6			*92	12	*61	23	31	2.31			SW	6	14	10	8		
Grand Meadow	68.8			*92	13	*54	6	38	3.80			SE	11	15	4	6		2
Grundy Center	74.5	84.7	65.1	89	18	56	25	33	3.07			NW						
Hampton	69.3	81.3	57.4	93	13	45	6	48	3.73			SE	11	18	1	6		
Hawkeye									2.87							5		
Hopeville	69.9	78.9	60.8	88	13	52	5	36	4.02			SE	3	24	3	10		
Humboldt									3.78			S	19	5	6	8		
Independence	69.0	80.1	57.8	91	19	47	6	44	3.57			SE	18	8	4	6		
Indianola	70.4	80.8	60.4	89	12	48	6	41	6.87			SW				11	1	
Iowa City	71.4	82.9	60.0	99	12	45	7	54	4.01			SE	4	24	2	9		
Iowa Falls	69.4	80.7	58.2	89	12	45	6	44	2.79			SE	17	7	6	9		
Jefferson	71.6	84.3	58.7	92	12	42	11	50	4.46			SE	10	20		18	1	
Keokuk	73.0	82.0	64.0	92	12	54	6	38	2.37			NW	12	12	6	10		
Keosauqua	72.9	83.8	62.8	95	12	49	7	46	2.72							8		
Larrabee	71.1	85.6	56.7	93	13	43	6	50	2.19			S	15	8	7	6		
Logan	71.8	83.3	60.3	93	20	50	22	43	3.97			S	18	5	7	4		
Marshalltown	70.6	79.7	61.5	87	14	49	6	38	4.64			S	14	15	1	9		
Mason City	70.5	83.1	57.9	93	13	54	21	39	5.41							8		
Maxon	72.5								5.88				11	17	2	9		
Mechanicsville	69.3	80.2	69.3	90	12	47	6	43	2.86			S	15	6	9	12		
Monticello	70.4			*95	19	*49	6	46	3.82			SE	17	12	1	8		1
Mount Vernon	72.9			94	17	54	6	40	4.30									
Mount Ayr	71.9	82.4	61.6	91	13	50	2	41	4.14				18	8	4	8		
Murray	70.4	80.7	60.0	93	19	49	6	44	5.35			S				9		
Newton	72.0	83.4	60.3	95	13	48	6	47	3.65			NW	17	6	7	8		
Omaha (Neb.)	73.0	82.1	64.1	90	19	53	5	37	7.11			SE	18	10	2	8		
Oskaloosa	70.6	81.0	60.1	91	12	48	6	43	4.87			SE	16	7	7	10		
Ovid	70.0	81.4	60.2	93	15	48	6	45	4.31									
Panama	69.6	80.9	58.3	88	20	45	6	43	4.48			S	19	6	5	5		7
Richland	71.4			100	12	53	5	47	3.53				6	23	1	9		1
Rock Rapids	70.8	85.8	55.6	95	12	43	5	52	1.36			S	21	8	1	4		3
Sac City	71.2	82.3	60.1	89	13	54	22	35	5.20			SE	13	9	8	6		
Seymour	70.8	81.0	60.0	95	18	47	6	48	5.06			S	15	9	6	10		
Sibley	69.1	83.0	55.2	90	11	40	5	50	2.41			S	16	8	5	7		
Sioux City	72.0	83.3	61.2	92	20	46	6	46	1.63			S	15	9	6	5		
Storm Lake	72.0	83.4	61.6	92	13	53	22	39	3.84			S	16	12	2	8	1	9
Tipton	71.4	83.4	59.3	93	19	48	5	45	2.18			S	17	9	4	11		4
Villisca	72.9	81.2	65.0	90	14	50	6	40	3.80			SW				7		
Vinton	70.4	80.5	59.2	*89	12	*53	6	36	3.19			SE	22	5	3	5		2
Washington	76.5	89.3	63.7	*100	19	*50	24	50	3.83			SW				9		
Webster City	70.5			*98	13	*36	5	42	2.76			SW	14	14	2	6	1	4
Williams	68.7			*92	13	*52	5, 6	40	3.01			S	14	11	5	11		
Winterset	70.8	81.9	59.9	92	13	50	22	42	5.86			S	13	8	9	8		1
Means	71.2	82.3	60.3	92.1		49.2		43.0	3.91			SE	14.6	10.7	4.9			

*Taken from observed readings; all others self-registering instruments.

DAILY AND MONTHLY MEAN TEMPERATURE FOR JUNE, 1893.

STATIONS.	DATE.																														Monthly Mean.
	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	
Algona	64	71	64	62	61	66	71	63	66	76	78	80	76	73	73	74	78	79	78	69	67	66	68	72	73	77	74	72	70	68	73.3
Ames (W. R. Cooper)	62	64	70	64	59	60	65	64	68	70	71	76	76	76	74	74	74	69	73	76	75	65	67	72	70	77	68	72	68	74	69.5
Ames (4 mi. S. W. of)	66	64	68	62	58	62	68	70	66	67	73	78	80	78	75	75	80	79	82	80	74	73	68	74	72	76	76	76	76	77	72.7
Amana	61	66	71	70	66	60	64	70	72	70	80	78	78	78	75	75	75	78	78	78	76	64	68	74	72	72	72	72	74	74	71.2
Atlantic	66	63	68	64	60	60	70	71	66	74	74	80	78	78	76	75	77	76	80	79	76	66	69	72	72	76	74	72	69	73	71.7
Audubon	66	66	67	67	62	64	66	71	68	70	72	79	76	78	78	77	78	77	78	78	75	70	68	71	75	72	72	72	72	74	71.6
Belle Plaine	61	65	72	68	64	60	64	68	72	70	79	79	79	76	74	74	76	76	77	76	76	64	68	74	72	72	72	72	73	74	71.9
Blakeville	60	64	71	64	61	64	64	66	72	65	68	81	80	78	74	74	77	76	80	77	70	75	77	77	72	72	72	78	78	76	71.8
Bonaparte	64	68	72	72	64	61	64	68	72	73	72	76	79	74	76	78	78	78	78	74	77	66	69	73	74	72	72	72	72	74	71.9
Carroll	66	66	72	63	65	58	67	72	67	72	72	83	79	75	78	73	78	80	79	73	77	65	72	73	73	75	74	72	72	73	72.2
Cedar Falls	64	64	73	71	62	62	66	70	71	70	68	76	77	74	76	74	76	74	74	72	66	64	76	66	66	66	68	72	72	74	70.2
Cedar Rapids	61	66	70	64	60	64	67	72	74	66	72	80	80	74	75	74	77	77	78	78	77	68	71	74	73	71	72	74	74	74	72.2
Centerville	61	66	70	66	62	61	66	68	70	77	78	81	82	74	75	74	75	76	78	76	76	68	73	74	72	72	72	72	75	74	72.2
Charles City	65	68	71	68	65	61	66	68	70	77	78	81	81	78	74	72	70	75	79	78	74	71	69	73	72	72	72	74	76	74	72.2
Clarinda	64	66	68	62	60	62	68	67	69	70	70	76	77	74	70	70	73	74	78	78	76	74	70	70	72	74	72	74	69	69	72.0
Clinton	60	68	72	70	68	62	64	70	74	65	70	78	76	78	76	74	75	78	78	78	76	68	70	70	72	74	72	74	72	74	72.5
College Springs	65	68	69	64	60	64	68	70	69	71	71	78	76	78	76	74	76	76	76	77	78	73	72	74	74	74	72	72	72	70	73.1
Corning	62	64	68	65	58	60	68	68	65	69	74	76	76	74	73	72	72	74	76	76	75	63	67	71	70	72	69	68	69	69	69.4
Cresco	60	65	69	66	58	58	64	68	66	66	64	77	78	72	71	71	72	72	74	74	70	62	66	71	66	66	65	72	69	71	68.2
Davenport	59	66	69	70	66	60	66	70	74	70	68	80	78	76	74	75	78	76	79	76	76	66	72	74	72	74	72	71	73	74	72.0
Delaware	58	65	66	68	62	63	66	70	70	64	66	79	78	74	71	72	74	76	79	74	72	64	64	73	72	76	73	72	72	69.9
Denison		66	65	69		66	70	75	66	72	76			77	72	73	76	78	78	78	67	77	67	70	74			70	67	70	71.0
Des Moines	62	65	70	64	61	60	68	70	68	70	72	79	80	76	75	74	74	78	77	76	78	68	74	74	72	72	72	72	74	74	71.0
Dubuque	59	67	68	72	66	62	68	70	74	64	67	79	79	77	75	74	75	76	80	78	75	67	71	74	74	70	70	72	74	74	72.0
Eagle Grove	63	64	68	62	60	62	67	71	62	68	71	78	79	78	69	74	76	76	78	79	70	64	71	71	70	71	72	71	74	74	70.4
Elkader	60	68	71	68	65	62	64	72	69	68	68	80	78	76	74	75	76	74	78	78	74	71	65	68	74	72	68	69	72	74	70.6
Emmetsburg	62	64	66	60	59	60	60	70	63	70	76	80	78	76	74	72	74	78	78	78	78	66	56	58	72	70	70	75	71	72	70	69.6
Ft. Madison	66	70	65	71	70	69	74	73	77	74	79	85	79	78	80	77	81	77	82	80	84	74	79	78	78	74	76	78	74	75	75.6
Grand Meadow	58	64	67	68	58	64	68	70	68	63	66	77	79	74	70	72	73	72	75	74	68	65	69	66	68	68	68	68	70	70	70	68.8
Grundy Center														78	76	75	76	78	76	76	72	69	80	73	70	71	72	74	72	73	73	69.3
Hampton	63	64	68	61	57	55	66	70	65	69	70	78	78	74	74	70	74	76	76	75	68	63	70	72	68	68	72	68	70	72	73	69.3
Hopeville	62	64	70	64	59	60	66	68	66	70	72	78	78	74	74	72	73	76	76	75	74	72	66	68	71	72	72	72	72	72	69	69.9
Independence	58	64	68	67	60	60	64	69	69	66	66	76	78	74	72	72	74	72	78	74	70	63	67	70	72	72	72	68	70	72	68	69.0
Indianola	63	65	70	68	59	61	67	69	69	70	72	78	78	74	72	75	75	76	76	76	66		68	72	73		72	68	71	71	70	70.4
Iowa City	61	66	70	69	64	61	62	68	72	70	72	83	80	76	77	72	72	76	78	74	72	78	68	72	73	68	72	68	69	72	72	71.4
Iowa Falls	61	63	67	67	64	60	62	70	66	68	74	80	78	76	74	72	73	76	76	76	64	63	68	72	69	68	66	69	70	72	69.4
Jefferson	62	64	66	66	61	58	62	67	72	74	62	84	83	78	74	72	73	76	78	78	80	66	68	72	72	68	68	74	72	71	74	71.6
Keokuk	63	68	71	72	66	63	66	70	74	75	72	84	78	74	76	74	79	78	80	77	77	68	72	74	72	76	74	74	74	74	73	73.0
Keosauqua	62	68	72	69	65	63	66	70	72	74	74	82	80	76	77	73	74	78	78	78	80	66	68	72	72	72	72	72	72	72	72	72.3
La Crosse, Wis	60	67	72	68	62	64	69	72	71	66	68	80	80	74	74	76	77	78	78	78	76	66	70	74	72	72	72	72	72	72	72	72.9
Larrabee	63	67	67	64	60	61	68	73	63	72	76	78	80	76	74	72	74	77	78	78	78	70	68	72	72	72	72	72	72	72	72	71.1
Logan	63	68	70	62	64	67	70	73	67	72	73	80	78	80	74	72	72	76	78	78	76	68	67	72	69	73	76	72	74	74	72	71.8
Marshalltown	60	72	70	70	62	60	66	70	71	68	68	77	71	76	73	74	74	74	74	76	76	74	66	70	70	73	76	72	72	73	73	70.6
Mason City	62	66	73	64	62	64	70	68	67	67	69	74	80	75	77	73	74	76	76	76	69	70	68	70	70	72	72	72	74	74	74	70.5
Maxon	60	71	71	68	60	62	72	72	74	66	76	82	79	73	76	72	76	78	79	76	73	67	75	76	74	71	74	73	76	72	72	72.5
Mechanicsville	58	64	68	68	62	60	63	66	71	67	66	78	78	74	72	72	72	74	77	74	72	64	68	72	72	71	70	72	72	72	72	69.3
Monticello	58	61	66	69	62	61	66	69	71	64	70	80	78	74	74	72	76	74	77	74	74	64	72	72	71	70	72	72	72	72	71	70.4
Mt. Vernon	62	70	72	69	63	64	67	74	72	68	74	82	82	77	74	78	79	78	82	80	71	64	72	76	74	73	74	72	76	78	74	72.9
Mt. Ayr	62	66	70	62	62	64	66	69	68	71	74	79	82	77	77	74	76	78	78	78	74		68		76	76	74	72	70	70	70	71.9
Murray	62	66	67	63	68	62	66	69	66	70	72	78	78	74	75	72	71	77	78	78	65	65	72	70	73	72	71	72	76			70.4
Newton	61	65	72	68	60	62	66	70	68	70	72	79	81	76	76	76	78	79	78	78	76	67	71	74	74	71	72	72	74	72	74	72.0
Omaha, Neb	66	68	69	62	62	65	70	75	68	71	78	80	79	78	74	74	76	80	81	80	76	68	72	75	76	76	74	75	70	74	73	73.0
Oskaloosa	62	65	70	65	61	60	65	70	70	70	72	80	78	74	74	74	72	76	78	78	74	64	68	72	72	72	69	71	71	71	71	70.6
Ovid	60	65	69	62	58	62	68	69	67	70	74	78	76	73	75	72	74	76	74	75	70	66	70	73	72	72	71	71	70	69	70	70.0
Panama	64	66	68	64	58	60	68	72	68	69	74	76	76	72	67	70	75	70	76	72	74	65	66	71	66	69	72	77	71	72	72	69.6
Richland	62	71	70	64	60	60	70	70	74	69	76	84	73	74	77	73	80	79	78	72	74	68	69	67	67	72	74	75	72	71	74	71.4
Rock Rapids	70	68	64	58	58	60	71	72	72	72	78	80	80	75	68	73	75	78	78	80	63	67	78	80	70	70	72	82	66	65	70	70.8
Sac City	62	66	66	69	70	72	75	70	69	71	72	79	77	72	71	72	76	77	74	75	68	69	68	74	70	69	70	72	74	75	72	71.2
Seymour	60	58	57	66	62	60	64	72	68	72	74	80	80	72	74	78	76	82	78	76	78	64	68	74	73	72	73	74	70	68	70	70.8
Sibley		64	65	62	54	58	66	73	67	70	73	78	75	76	74	68	72	74	76	76	72	62	67	70	66	66	68	70	72	72	72	69.1
Sioux City	65	68	65	64	61	62	70	77	64	70	78	81	79	80	71	72	74	80	79	80	74	70	70	74	71	76	76	72	72	72	72	72.0
Storm Lake	64	76	70	65	63	63	68	72	68	70	76	80	80	78	76	72	76	78	79	79	72	68	69	72	72	74	74	74	78	73	73	72.4
Tipton	59	69	72	67	61	60	66	69	71	68	74	82	76	73	74	74	77	80	78	78	78	67	72	74	72	74	74	76	74	74	74	71.4
Villisca	65	64	70	74	60	60	68	72	76	66	76	76	76	80	77	74	76	76	80	80	80	70	74	72	75	77	76	74	74	74	74	73.9
Vinton	60	66	68	65	59	60	68	70	70	66	70	80	76	72	74	72	80	74	79	74	76	66	70	73	69	69	68	72	73	72	70	70.4
Washington	64	74	73	69	68	66	72	76	78	71	78	87	83	78	82	81	83	81	86	82	72	71	76	71	70	69	74	80	80	82	81	76.5
Webster City	62	64	70	62	57	60	68	70	62	69	75	79	80	78	74	72	76	76	77	77	66	67	70	70	69	69	71	78	73	72	70	70.5
Williams	58	62	68	60	56	60	68	70	64	66	72	78	76	74	70	74	73	74	75	75	76	76	64	65	65	71	70	71	69	72	69	68.7
Winterset	62	66	71	64	58	61	68	71	68	70	68	80	78	76	74	73	74	75	75	76	76	64	69	74	74	72	72	74	70	72	70.8

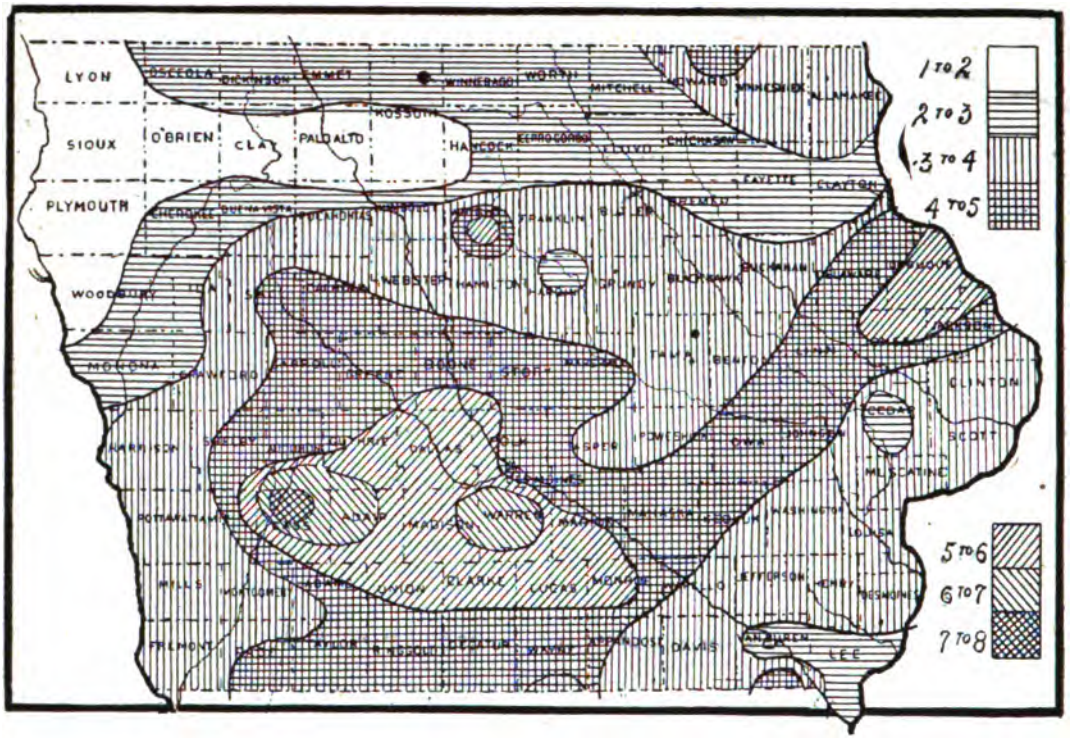
DAILY AND MONTHLY PRECIPITATION FOR JUNE, 1893.

STATIONS.	DATE.																													Total.
	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th	27th.	28th.	29th.	30th.	
Algona	....	....	.15	.75	....	....	....	....	.09	....	....	....	....	....	.45	....	....	....	....	....	.26	....	....	....	....	....	....	....	....	....	1.69
Ames (W. R. Cooper)	.04	.35	....	.82	....	....	....	....	.05	1.80	....	....	....	.07	....	.87	....	....	....	....	.12	....	.27	....	....	....	....	....	.01	.50	4.90
Ames, four miles west of	.04	.37	....	.78	....	....	....	....	....	1.93	.02	....	....	.06	....	.78	....	....	....	....	.90	.26	....	....	....	....	....	....	.01	.44	5.59
Amana	.33	....	.45	.41	....	....	....	....	....	1.41	....	....	....	.19	....	....	....	....	....	....	1.10	.36	.03	....	....	....	....	....	....	....	4.28
Atlantic	....	.54	.97	.28	....	....	....	....	3.60	.67	....	....	....	T	.06	....	....	....	....	....	1.44	....	....	....	....	....	....	....	T	....	7.56
Audubon	....	.30	....	1.00	....	....	....	....	.17	1.31	....	....	....	T	.01	....	....	....	....	....	1.04	....	0.20	....	....	....	....	....	T	....	4.93
Belle Plaine	.02	....	.08	.88	....	....	....	....	T	.55	....	....	....	....	....	....	....	....	....	....	.99	.41	.07	....	....	....	....	....	....	.43	3.43
Blakeville	T	....	....	.42	....	....	....	....	....	1.06	....	....	....	.50	....	.51	....	....	....	....	.76	....	.06	....	....	....	....	....	....	T	3.30
Bonaparte	.10	....	....	.61	....	....	....	....	....	.09	....	....	....	.85	....	....	....	....	....	.21	1.60	....	.73	....	....	....	....	....	.08	....	4.27
Carroll	....	....	.22	.99	....	....	....	....	.06	.52	....	....	....	....	.95	....	....	....	....	....	.52	....	.16	....	....	....	....	....	.22	....	....
Cedar Falls	.20	....	.05	.35	....	....	....	....	....	1.15	....	....	....	.25	....	....	....	....	....	.95	....	....	....	.20	....	....	....	....	....	....	3.15
Cedar Rapids	.62	T	.48	.08	.40	....	....	....	....	1.32	.38	....	....	....	....	....	....	....	....	....	.14	1.40	....	.07	....	....	....	....	....	....	4.80
Centerville	.17	T	.30	1.10	....	....	....	....	....	.20	....	....	T	T	....	T	....	....	T	....	1.00	....	....	.28	....	....	....	....	....	....	3 05
Charles City	.01	.13	.01	.54	....	....	....	....	....	.24	....	....	....	.15	....	.02	....	....	....	....	....	.45	.01	....	....	....	.01	....	1.14	....	2.71
Clarinda	....	....	....	1.30	....	....	....	....	....	1.17	....	....	....	01	....	.79	....	....	....	....	.85	....	....	....	....	....	....	....	....	....	4.12
Clinton	.44	.02	.33	.05	....	....	....	....	.19	.77	....	....	....	....	....	.20	....	....	....	.56	.27	....	....	....	....	....	....	....	....	.39	3.22
College Springs	....	....	....	1.38	....	....	....	....	.03	1.31	....	....	....	....	.80	T	....	....	....	....	.74	....	....	....	....	....	....	....	.02	....	4.37
Corning	....	....	....	1.28	....	....	....	....	.06	.73	....	....	....	....	T	....	....	....	....	....	1.47	....	....	....	....	....	....	....	.09	.19	3.82
Cresco	T	.36	....	.33	....	....	....	....	....	.23	....	....	....	1.32	....	1.20	....	....	....	....	.45	....	T	....	....	....	....	....	.25	....	4.14
Davenport	.32	....	1.05	.17	.04	....	....	....	.04	.72	....	....	.51	....	....	....	....	....	....	.15	.07	.30	T	.03	....	....	....	....	....	.42	3.82
Delaware	.12	....	1.24	.36	....	....	....	....	....	.79	....	....	....	....	.15	....	....	....	....	.07	1.40	....	.11	....	....	....	....	....	....	.05	4.20
Denison	....	T	1.71	T	....	....	....	....	.60	T	....	....	....	T	.18	....	....	....	....	....	.32	....	.24	....	....	....	....	....	....	....	3.05
Des Moines	.02	....	.06	.40	....	....	....	....	.03	.92	1.81	....	T	.03	.14	.28	....	....	....	....	.08	.20	.58	....	....	....	....	....	T	.14	4.69
Dubuque	.37	....	1.16	....	....	....	....	....	....	2.84	....	....	....	.04	....	....	....	....	....	.06	.12	....	T	....	....	....	....	....	....	....	5.49
Eagle Grove	....	....	....	1.10	....	....	....	....	T	.25	.20	....	....	....	2.15	T	....	....	....	....	1.60	.60	....	....	....	....	....	....	....	....	5.90
Elkader	.07	....	.11	.25	....	....	....	....	....	1.13	....	....	....	.37	....	....	....	....	....	.03	.52	....	.07	....	....	....	....	....	....	.37	2.92
Emmetsburg	....	....	....	.79	....	....	....	....	....	.29	....	....	....	....	.05	....	....	....	....	....	.60	....	....	....	....	....	....	....	....	....	1.73
Ft. Madison	1.02	.50	....	.22	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	T	.71	....	.54	....	....	....	....	....	....	....	2.35
Grand Meadow	.12	....	....	.33	....	....	....	....	T	1.47	....	....	....	.95	....	....	....	....	....	T	.85	....	T	T	....	....	....	....	....	.08	3.80
Grundy Center	....	....	....	....	....	....	....	....	.60	1.00	....	....	....	....	....	.23	....	....	....	....	1.09	....	.14	....	....	T	....	....	....	.01	3.07
Hampton	T	T	....	.52	....	....	....	....	....	.33	....	....	....	.15	1.98	....	....	....	....	....	.60	....	.17	....	....	....	....	....	....	....	3.75
Hawkeye	....	....	....	....	....	....	....	....	....	....	.44	....	....	.28	....	....	....	....	....	....	1.44	....	.07	....	....	....	....	....	....	.64	2.87
Hopeville	.06	T	....	1.38	....	....	....	....	.05	.67	.21	....	....	....	....	....	.19	....	....	....	1.27	....	T	.03	....	....	....	....	.08	.11	4.02
Humboldt	....	.02	....	1.65	....	....	....	....	.11	....	....	....	....	....	1.24	....	....	....	....	....	.44	....	.26	....	....	....	....	....	....	.06	3.78
Independence	T	....	.20	.65	....	....	....	....	T	1.00	....	....	....	....	....	....	....	....	....	....	1.50	....	.12	....	....	....	....	....	....	.10	3.57
Indianola	.60	T	.04	.72	T	T	....	....	.49	1.57	2.50	....	.05	T	....	.23	.32	....	T	....	.43	.46	....	....	....	....	....	....	....	....	6.87
Iowa City	.26	....	.23	23	....	....	....	....	.07	.27	....	....	.33	....	....	....	....	....	....	.05	....	1.47	.10	....	....	....	....	....	....	....	4.01
Iowa Falls	....	.05	.15	.26	....	....	....	....	....	.62	....	....	....	T	.28	.10	....	....	....	....	1.00	....	.10	....	....	....	....	....	....	.23	2.79
Jefferson	.05	.04	T	.85	....	....	....	....	....	1.70	.15	....	....	....	....	T	T	....	....	....	1.05	....	....	50	....	....	....	....	....	.12	4.46
Keokuk	.34	....	.06	.52	.02	....	....	....	T	.01	....	....	T	....	....	....	....	....	....	T	.42	.45	....	.42	.12	....	....	....	....	.01	2.37
Keosauqua	.15	T	....	.22	....	....	....	....	T	.05	T	....	T	T	....	....	....	....	.05	.10	.72	1.08	.35	T	....	....	....	....	....	T	2.72
Le Claire	.91	.10	.11	.39	.04	....	....	....	.40	.34	....	....	1.24	....	....	....	....	....	....	....	.21	....	....	....	....	....	....	....	....	....	3.74
La Crosse (Wis)	.05	.01	....	.07	....	....	....	....	....	.12	....	....	....	.73	....	....	....	....	....	....	.85	....	....	T	....	....	....	....	....	.48	2.31
Larrabee	....	.07	1.09	T	....	....	....	T	....	.20	....	....	....	....	.32	....	....	....	....	....	.26	....	T	....	....	....	....	....	.25	T	2.14
Logan	....	....	....	1.30	....	....	....	....	.97	....	....	....	....	....	.45	....	....	....	....	....	1.07	....	....	....	....	....	....	....	....	....	3.79
Marshalltown	....	.10	....	.32	....	....	....	....	....	1.55	.43	....	....	....	.72	.46	....	....	....	....	.73	....	.21	....	....	....	....	....	....	.12	4.64
Mason City	....	.50	....	....	.70	....	....	....	.30	....	....	....	....	.22	....	....	....	....	....	....	.60	....	.04	....	....	....	....	....	.05	3.00	5.41
Maxon	.14	....	1.00	1.22	....	....	....	....	....	.32	T	....	T	.38	....	1.32	....	....	.12	....	1.08	....	T	....	....	....	....	....	T	.30	5.80
Mechanicsville	.47	....	.41	.01	.01	....	....	....	.05	.62	....	....	.10	.01	....	....	....	....	....	.47	.66	....	.04	....	....	....	....	....	....	.01	2.86
Monticello	.24	....	1.31	.53	....	....	....	....	....	2.59	....	....	....	.02	....	....	....	....	....	.93	....	....	.11	....	....	....	....	....	....	.09	5.82
Mt. Ayr	T	....	.19	1.38	....	....	....	....	....	.65	.56	....	....	....	....	.62	....	....	.15	....	.60	....	....	.19	....	....	....	....	....	T	4.14
Murray	.09	....	....	1.24	....	....	....	....	.08	1.04	.59	....	.01	.23	....	....	....	....	....	....	1.20	....	....	....	....	....	....	....	....	.89	5.37
Newton	....	....	....	.31	....	....	....	....	.07	1 54	.76	....	....	.16	....	.03	....	....	....	....	.37	....	.41	....	....	....	....	....	T	T	3.65
Omaha (Neb)	T	.43	1.14	2.41	.04	....	....	....	.09	1.84	....	....	....	....	T	....	....	....	....	....	.81	....	T	....	....	....	....	....	.35	T	7.11
Oskaloosa	.50	....	.95	.62	....	....	....	....	.27	....	.12	....	....	T	....	.36	....	....	.12	T	1.50	....	.60	....	....	....	....	....	....	.28	4.87
Ovid	.10	....	.26	1.60	....	....	....	....	.01	.46	.16	....	.01	.13	....	T	....	....	....	....	1.52	....	.05	T	....	....	....	....	.01	....	4 31
Panama	....	....	1.20	....	....	....	....	....	1.13	....	....	....	....	....	1.39	....	....	....	....	....	.67	....	....	....	....	....	....	05	....	....	4.44
Richland	.22	T	.08	36	....	....	....	....	....	.39	....	....	....	.07	....	....	....	....	....	....	24	1.65	.38	T	T	....	....	....	.14	....	3.53
Rock Rapids	.12	T	.75	....	....	....	....	T	....	....	....	....	....	....	....	....	....	....	....	....	.37	....	....	T	....	....	....	....	.12	....	1.36
Sac City	....	....	2.25	....	....	....	....	....	.25	....	....	....	....	....	1.00	....	....	....	....	....	....	.80	....	....	....	....	....	....	.10	.80	5.20
Seymour	.83	.03	.05	1.03	....	....	....	....	....	.42	.08	....	....	....	....	.22	....	....	....	....	1.80	....	.55	.05	....	....	....	....	....	....	5.06
Sibley	.08	1.02	.21	....	....	....	....	....	....	.04	....	....	....	....	.37	....	....	....	....	....	.43	....	....	....	....	....	....	....	.33	....	2.41
Sioux City	....	....	.09	.35	....	....	....	T	T	.10	....	....	....	....	.03	....	....	....	....	....	T	....	.16	....	....	....	....	....	....	....	1.63
Storm Lake	....	.05	.88	....	....	....	....	T	....	.04	....	....	....	....	.40	....	....	....	....	....	.18	....	1.82	....	....	....	....	.50	T	....	3.84
Tipton	.17	....	.20	.02	....	....	....	....	....	.67	....	....	.05	.01	....	....	....	....	.09	.06	.62	....	.12	....	....	....	....	....	....	.17	2.18
Villisca	.04	....	....	1.99	.03	....	....	....	....	.72	....	....	....	....	....	.26	....	....	....	....	....	.47	....	....	....	....	....	....	....	.29	3.80
Vinton	....	....	....	.36	....	....	....	....	....	1.48	....	....	....	....	....	T	....	....	....	T	1.09	....	.23	....	....	....	T	....	....	.03	3.19
Washington	.30	....	.50	.12	....	....	....	....	....	.52	....	....	....	....	....	....	....	....	....	.15	1.34	.67	.50	....	....	....	....	....	....	.18	3.83
Webster City	.25	....	....	....	....	....	....	....	.12	.62	....	....	....	T	T	.25	....	....	....	T	1.12	....	.40	....	....	....	....	....	T	T	2.76
Williams	....	.08	....	.87	....	....	....	....	.02	.42	.03	....	....	.05	....	.22	....	....	....	....	.94	....	.21	....	....	....	....	....	.02	.15	3.01
Winterset	....	....	....	.99	....	....	....	....	1.53	....	.55	....	....	....	.32	1.10	....	....	....	....	1.36	....	.02	....	....	....	....	....	T	.20	5.56

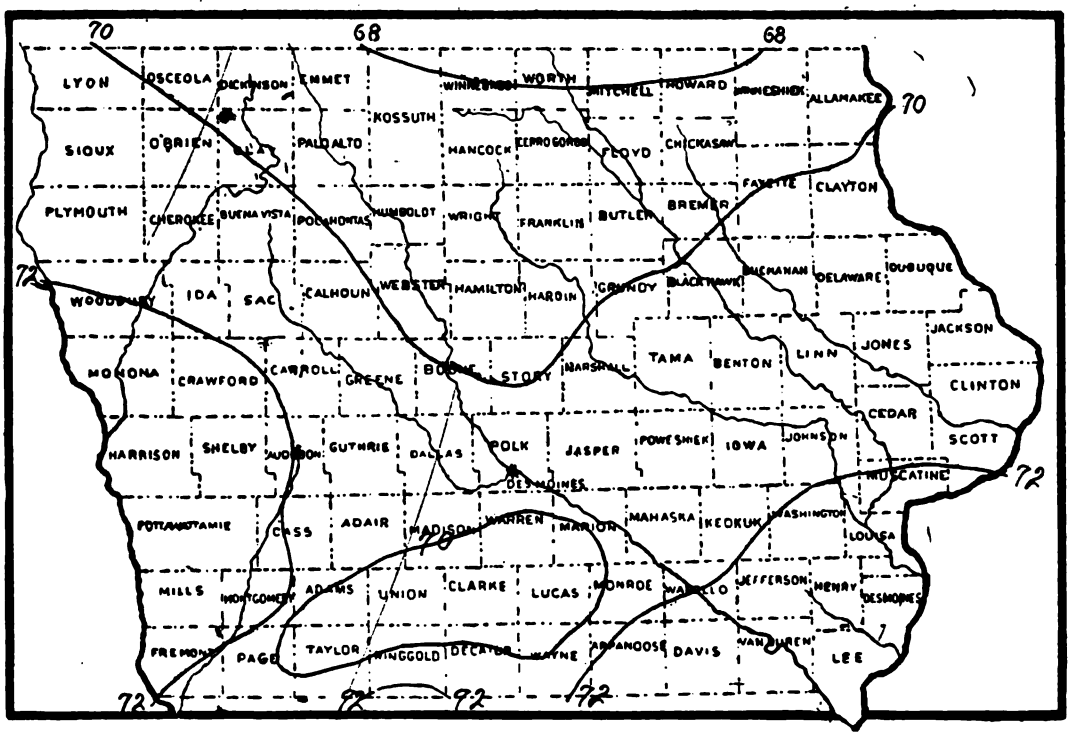
MAXIMUM AND MINIMUM TEMPERATURE FOR JUNE, 1893.

| STATIONS. | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | | 9 | | 10 | | 11 | | 12 | | 13 | | 14 | | 15 | | 16 | | 17 | | 18 | | 19 | | 20. | | 21 | | 22 | | 23 | | 24 | | 25 | | 26 | | 27 | | 28 | | 29 | | 30 | | Monthly Mean. | |
|---|---|---

IOWA PRECIPITATION CHART JUNE 1893.



MEAN TEMPERATURE JUNE 1893.



METEOROLOGICAL STATIONS AND OBSERVERS.

From the following, weekly and monthly reports of Meteorological data are received by the Iowa Weather and Crop Service.

Albia.....Geo. Price.
Algona.....C. D. Pettibone.
Alta.....D. E. Hadden.
Amana.....Conrad Schadt.
Ames.....E. C. Dickinson.
Ames.....E. N. Eaton
Ames, (4 miles S. W.).....Isaac Young.
Atlantic.....J. W. Love.
Audubon.....J. F. Hocker.
Belle Plaine.....H. W. Vandike.
Blakeville.....James Rodgers.
Blockton.....C. W. Thompson.
Bonaparte.....Hon. B. R. Vale.
Carroll.....Moses Simon.
Cedar Falls.....Prof. A. C. Page.
Cedar Rapids.....H. D. Olds.
Centerville.....Prof. R. E. Reister.
Charles City.....J. W. Smith.
Clarinda.....A. S. Van Sandt.
Clinton.....Luke Roberts.
College Springs.....A. A. Berry.
Concord.....J. M. Elder.
Corning.....John W. Bixby.
Cresco.....Gregory Marshall.
Council Bluffs.....E. W. Hart.
Davenport.....*F. J. Walz.
Delaware.....Wm. Ball.
Denison.....P. H. Schlumberger.
Des Moines.....*Geo. M. Chappel, M. D.
Dubuque.....*S. C. Emery.
Eagle Grove.....C. A. Schaffter.
Eldora.....Prof. C. F. Woodward.
Elkader.....Chas. Reinecke.
Emmetsburg.....H. Conroy.
Estherville.....L. L. Bingham.
Fairfield.....J. Fred Clarke, M. D.
Fayette.....R. Z. Latimer.
Ft. Madison.....Miss L. A. McCready.
Galva.....Dr. D. W. Farnsworth.
Glenwood.....Seth Dean.
Greenfield.....J. G. Culver.
Grinnell.....Prof. S. J. Buck.
Grundy Center.....Chas. G. Rogers.
Hampton.....E. C. Grenelle.
Hawkeye.....J. W. Bopp.
Hopeville.....M. T. Ashley.
Hopkinton.....Theo. Marks
Independence.....E. F. Wulfke.
Indianola.....Prof. J. L. Tilton.
Iowa City.....Prof. A. L. Arner.
Iowa Falls.....J. B. Parmelee.
Jefferson.....Dr. Chas. Enfield.
Keokuk.....*Fred. Z. Gosewisch.
Keosauqua.....Prof. J. H. Landes.
Larrabee.....H. B. Strever.
La Crosse, Wis.....*W. U. Simons.
Logan.....Mrs. M. B. Stern.
Mason City.....H. I. Smith.
Manson.....W. L. Thompson.
Marshalltown.....L. S. Kilborn.
Maquoketa.....Dr. A. B. Bowen.
Mechanicsville.....Rev. J. W. Hubbard.
Milton.....Hon. E. C. Holland.
Mooar.....F. G. Thomas
Monticello.....Henry D. Smith
Mount Vernon.....Prof. A. Collin.
Mt. Ayr.....Hon. Wm. Shriver.
Murray.....A. W. Lewis.
Muscatine.....J. P. Walton.
Newton.....A. Lufkin
Omaha, Neb.....*Geo. E. Hunt.
Ovid.....H. C. Miller.
Osage.....G. D. Pattingill
Oskaloosa.....Jos. Boyd.
Panama.....Wm. J. Wicks.
Postville.....F. L. Williams.
Richland.....Wm. A. Shaffer.
Rock Rapids.....W. C. Wyckoff.
Seymour.....Mrs. C. A. Conger.
Sibley.....H. G. Doolittle.
Sidney.....G V. Swearingen.
Sioux City.....*U. G. Pursell.
Sac City.....Dr. C. Brown.
Spirit Lake.....W. A. Siddall.
Storm Lake.....A. J. Bond.
Tipton.....J. M. Rider.
Vinton.....T. F. McCune.
Villisca.....Hon. J. S. Boise
Washington.....Wm. A. Cook.
Webster City.....C. M. Trumbauer.
Winterset.....Will McKnight.
West Bend.....Phil. Dorweiler
Williams.....M. L. Fuller.

*U. S. Weather Bureau.

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Ford.....W. W. Whitmore.
Fort Dodge.....R. W. Blaine.
Geneva.....Wm. H. Thompson.
Gosport.....B. F. Banta.
Grand River.....Dr. John Daykin.
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Harlan.....Fred Fischer.
Hesper.....G. E. Dillingham.
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Hamlin.....F. P. Moore.
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Orange City.....H. J. VandeWaa.
Paton.....Hon. Joshua Jester.
Pittsburg.....G. C. Duffield.
Polo Station.....A. E. Miller.
Prescott.....G. W. Iden
Paullina.....Geo. Hakeman.
Rockwell City.....J. G. Palmer.
Rock Rapids.....D. E. F. Merrill.
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Sandusky.....Z. Hollingsworth.
Sageville.....Hon. F. N. Knoll.
Shenandoah.....Reuben Mullison.
State Center.....E. N. Thompson.
Sumner.....John Dawson.
Tama.....W. G. Malin.
Van Horn.....Spencer Smith.
Wapello.....O. P. Smith.
Waukee.....John Wragg
Wheatland.....D. Beckman.
Willow Creek.....W. S. Nicholson.
Winterset.....H A. Kinsman.
Wall Lake.....I. E. Wilcox.
Walnut.....F. L. Martin.
What Cheer.....O. D. Lawrence.

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MONTHLY REVIEW

OF THE

IOWA WEATHER AND CROP SERVICE.

VOL. IV.] JULY, 1893. [No. 7.

THE POMEROY TORNADO.

On the evening of July 6, 1893, a tornado originated near the center of the southern half of Cherokee county, and moved on a general line about 15 degrees south of east a distance of nearly 56 miles. After leaving Cherokee the storm swept through the southern townships of Buena Vista county, across the southwest corner of Pocahontas county, and thence two-thirds of the distance through Calhoun county, crowning its career of devastation by destroying the larger part of the residence portion of the thriving town of Pomeroy. This tornado caused greater destruction of life than any storm that ever visited Iowa, and in respect to destruction of property it ranks second only to the noted Grinnell tornado of June 17, 1882.

EVIDENTLY A TORNADO.

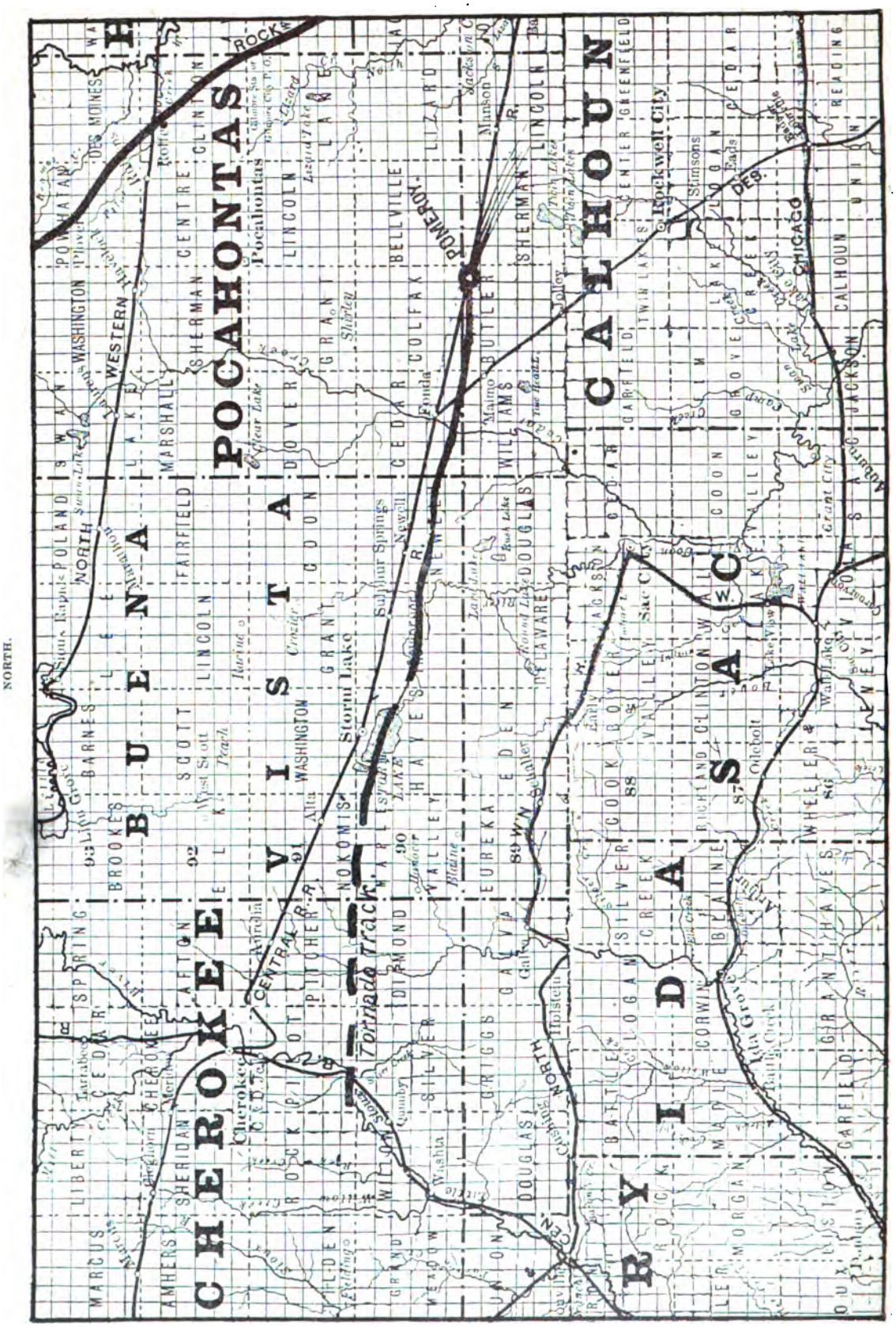
Judging by the debris and other visible effects at Pomeroy, and the descriptions of observers at other points, the storm bore all the characteristics of a tornado. The width of its path was variable, ranging from 800 to 1,800 feet. A number of intelligent observers distinctly saw the whirling and writhing pendant, which they variously describe as funnel-shaped, like an elephant's trunk, etc. Others, who were very near the path of the storm, saw only a great mass of densely black or greenish vapor rolling over the ground like a swirl of Missouri river waters, accompanied by electric flashes and an indescribable roar or humming sound, unlike any noise ever heard before. The scene was quite different at various points of observation, the mass of clouds alternately lifting and falling, changing form continuously as it advanced. One observer says he saw two huge masses of white clouds approaching, one from the southwest and the other from the northwest; between them was a mass of inky, black vapor, from which trailed four elongated trunks that swayed and twisted and bounded up and down as they swung along, and only one touched the ground in passing his place. Making due allowance for an excited imagination, there is doubtless a measure of truth in the many seemingly conflicting reports as to the appearance and behavior of the storm. They all attest the fact that it was a genuine "twister" of the most virulent type.

THE STORM'S TRACK.

The path of the tornado is quite accurately outlined in Fig. I, giving a sectional map of the territory through which it passed. Through the first half of its journey the storm lifted at frequent intervals, bounding and swaying slightly north and south of its general path; but after passing Storm Lake it gathered new force and kept more continuously to its work of destruction, making a line nearly as direct as the flight of an arrow toward the fated town of Pomeroy. On the north side of its path are seen occasional indications of lateral currents, some of which left wreckage in their course, giving apparent ground for the statement that the main storm pursued a zigzag pathway.

TIME SCHEDULE.

According to the various reports as to the hour of the evening when the tornado passed the different points on the line of its travel, its progressive movement eastward was quite slow. It began its work in Cherokee county at about 5:00 P. M. Observer Hadden states that it passed south of Alta at 5:20. Observer Bond, of Storm Lake, reports it as having passed by that place at 5:30. Postmaster Blair, of Newell, gives the hour of its appearance at a point about a mile south of that place at 6:00. And all accounts agree that it struck the town of Pomeroy between 6:30 and 7:00 P. M. The *Herald* of that place states that it was just 7 o'clock when the storm began its work. The writer saw a pendulum clock among the debris which had been stopped at 6:40. So making due allowance for the variation in time pieces, the storm must have occupied an hour and forty minutes in traveling fifty miles, making about the usual speed of an express train. Evidently the tornado could have been handled or scheduled quite easily by a good train dispatcher, and people in the towns along its line could have been warned to side-track before it reached their stations. In this there is at least a suggestion of the possibility of establishing a system of warning whereby lives may be saved.


CHEROKEE
BUENA VISTA
POCAHONTAS
CALHOUN
WRIGHT
HUMBOLDT
IDA
SAC
Cherokee
Pocahontas
Rockwell City
Storm Lake
Newell
Sioux Rapids
Alta
Aurelia
Marcus
Correctionville
Moville
Sergeant Bluff
Sioux City
Smithland
Danbury
Anthon
Battle Creek
Ida Grove
Odebolt
Wall Lake
Lake View
Early
Lytton
Sac City
Auburn
Lake City
Manson
Pomeroy
Fonda
Farnhamville
Lohrville
Yetter
Calhoun
Gowrie
Knierim
Farnhamville
Jolley
Lanesboro
Varina
Arthur
Galva
Schaller
Truesdale
Holstein
Quimby
Washta
Cleghorn
Meriden
Cleghorn
Aurelia
Correctionville
Moville
Sergeant Bluff
Sioux City
Smithland
Danbury
Anthon
Battle Creek
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Lake City
Manson
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Fonda
Farnhamville
Lohrville
Yetter
Calhoun
Gowrie
Knierim
Farnhamville
Jolley
Lanesboro
Varina
Arthur
Galva
Schaller
Truesdale
Holstein
Quimby
Washta
Cleghorn
Meriden
Cleghorn
Tornado track
CENTRAL R.R.
C. & N.W. R.R.
CHICAGO
NORTH.

FIG. I.

Though the storm traveled quite slowly eastward, its whirling and uplifting movements must have been inconceivably rapid, and there is no evidence that it was wasting any time on its way.

SOME NOTEWORTHY POINTS.

The fact has been stated that the general direction of the tornado was a little south of east. The first twenty miles of its course was almost due east, and if it had held steadily to that line it would have struck the thriving and handsome city of Storm Lake. But on approaching the northwestern point of the lake it deflected slightly southward, that body of water evidently offering the line of least resistance. After reaching the more level region beyond the outlet of the lake its path was very nearly on a direct air line, about parallel with the Illinois Central track.

The weather records show that fully 80 per cent of tornadoes move from the southwest to the northeast. It is a noteworthy fact, however, that the three longest and most destructive storms of that character that have visited Iowa, viz., the Camanche tornado of 1860, the Grinnell tornado of 1882, and the late Pomeroy storm, all moved on a line trending toward the southeast. There appears to be something more than coincidence in the fact that these three major storms have pursued the same general course, apart from the line of minor disturbances. The suggestion may be offered that the more powerful northwest currents not only give direction but also add to the intensity of the whirling columns.

Another point may be noted here. Intelligent residents at Pomeroy, who took note of the approach of the storm from the west, state that it appeared to have originated at that place. The Pomeroy *Herald* says:

"The sky was a fearful sight to behold, clouds of inky blackness filling the entire west, rolling and surging in wild commotion. One cloud came from the northwest and joined a second from the southwest, then whirled and sucked its resistless passage toward the fated town. The air was filled with flying debris and the roar of the storm was above all."

Observers at the various stations along the line relate that they saw two clouds approach each other, and then the work of destruction began. At every point of observation it looked as if the meeting of these clouds of vapor—visible air currents—caused the disturbance. Evidently these were lateral currents drawn into the central vortex, possibly serving as feeders of the devastating monster. In nearly all descriptions of tornadoes in the papers, and by local observers, we note the same account of clouds meeting clouds. In a study of this class of storms this fact is deserving of consideration.

REPORT BY DAVID E. HADDEN, OF ALTA.

From the very full detailed report by Prof. David E. Hadden, of Alta, Buena Vista county, we make the following extracts:

On July 5th, the day preceding the tornado, the wind blew briskly from the southeast all day, with increasing cloudiness and a moderately heavy thunder-storm towards evening. The sky had a very threatening appearance, heavy dark clouds and very vivid lightning. The morning of the 6th opened with a light east wind, partly cloudy sky which gradually increased, the wind bearing to southeast and almost calm. The morning was "close," and murky and the sultriness greatly increased, becoming very oppressive during the afternoon. About 4:00 P. M., the sky assumed a stormy appearance, "thunderheads" appeared in the west and northwest. At 4:20 P. M. thunder was first heard in the northwest, proceeding from a bank of dark clouds. Soon the lightning became "forked" and several sharp peals of thunder quickly followed the rapidly advancing portion of the thunder-cloud. About this time the lightning in the northwest was continuous and the thunder incessant, a peculiar rumbling roar continued, which was unlike any sound produced by even distant thunder; this continued until about 5:00 P. M. The dark bank of clouds in the northwest seemed to have traveled northeastward. At 5:00 P. M. a very large heavy, dark mass of clouds was seen almost due west and apparently at a distance of about three or four miles.

Much sharp lightning and thunder accompanied it. As it advanced it was seen to be in violent commotion, a strong ascending current appearing in its midst. It traveled in a southeast direction. About 5:15 P. M. a heavy, rapidly moving cloud was seen to move from a southeast to northwest direction, meeting the advancing storm; it suddenly dipped and raised, then dipped and raised again and traveled eastward, south of Alta, at a distance of about two to three miles. At the same time intensely sharp lightning and deafening thunder peals passed over the town, traveling in an east and northeast direction. This continued until 5:30 P. M. At 5:15 or 5:20 P. M. the wind suddenly blew hard from the northeast for about ten minutes when it gradually decreased and veered to north, then west, then variable. At 5:30 P. M. very large hail, in some cases several inches in diameter, very angular and honey-combed, came from the north, breaking hundreds of windows, limbs of trees, etc. At 5:35 P. M. the hail ceased; the ground was covered almost white, and were it not for the light wind then prevailing, the damage by this source would have been much more serious. Heavy rain commenced falling at 5:30 P. M. and ceased at 5:40 P. M.; amount, .28 inch. Immediately after the storm passed, the east and southeast sky was of an inky blackness. Swiftly moving, large masses of dark cloud at a low elevation were observed to come from the northwest toward the storm region. After this the sky partly cleared, but about 8 P. M. a heavy thunder-storm with very hard rain came up from the southwest and lasted about three hours, accompanied by a high, northeast wind from 10 P. M. to 10:25 P. M.

The tornado entered Buena Vista county about four miles southwest of Alta and passed across the county. The tornado passed through the center of the lake, raising the water to a height of about 100 feet.

The hail was confined almost entirely to the track of the tornado and for about two miles on the north side of the track; but little occurred south.

Mr. J. H. Wadsworth was injured about the face, as if by fire, he thinks he was enveloped in a "stream of electricity;" it seems difficult to account for the character of his injuries otherwise.

Mr. C. W. Garberson, living about eight or nine miles on the north side of the storm track, says that many hundred balls of fire filled his yard, coincident with a blinding flash of lightning which struck a private line telegraph pole near his house.

On the south of the track a brisk wind from the southeast or east preceded the tornado, followed, during its passage east, by a high westerly wind.

A grove on the west side was unharmed, while a fine, large barn a few rods east on Henry Tutt's farm was completely demolished.

Chickens were found alive and completely stripped of all feathers.

Near the Hetrick farm the fence running north and south was plastered with mud on the northwest side of the posts to a depth of many inches.

Large trees over a foot in diameter were twisted in all conceivable forms, as if they were mere twigs.

The direction of motion of the funnel cloud was from south to west by the east. In some places debris was so scattered as to indicate a straight blow, while in others the "twister" was plainly seen.

In some instances an expansive force was evident, the sides being blown outward in all directions; in others, the "uplift" was tremendous.

The sky became exceedingly dark just before the storm struck.

Charles Anderson on the Joseph Boulting farm found one of his horses lodged in a tree, while its mate was carried clean over the grove and deposited in a field.

A reaper wheel of solid iron was carried from the Slate place and dropped in the field, half a mile away. A board was forced edgeways half through a tree, and so firmly imbedded that it could not be broken off.

The following persons residing in this county were killed or have since died:

B. Johanneson, aged about twenty years.
Chas. Totman, aged about fifty years.
W. R. Clemons, aged seventy-eight years.
Jacob Breecher.
Jacob Breecher's daughter, aged five years.
Joseph Slade, aged about sixty years.

Estimated losses in Buena Vista county, extract from Storm Lake *Tribune:*

W. L. Chamberlain, house, outbuildings, corn, orchard and trees	$1,500
Wm. Clemons, house, furniture and clothing	1,400
L. A. Clemens, house, barn, tools, orchard and trees	2,500
Charles Totman., house, furniture, clothing, stock, machinery, crops, etc	1,448
Thos. Wall, machinery, stock, crops, clothing	795
Donald Hill, barns, cribs, machinery	800
C. Hetrick, house, barn and wind-mill	1,300
Jacob Brecher, house, barn, granary, machinery, crops, stock, clothing, etc	3,500
S. J. Powell, house, barn, sheds, and crops	1,500
J. Whitmore, machinery, furniture, clothing	800
Sam Coulson, corn	60
G. L. Watson, house and barn	1,000
Henry Tutt, barn, granary	800
Henry Fisher, barn, steamboat	1,000
Albert Scharn, machinery, stock, crops, furniture clothing	1,066
Patrick Kennedy, two horses and barn	150
Total	$19,610

There were three other losses not included in the above that of the Lake Side farm, estimated at $5,000, at V. A. Bryant's $1,000 and at Frank Snyder's about $500.

REPORT BY A. J. BOND, STORM LAKE.

Observer A. J. Bond, of Storm Lake, sent notes and newspaper clippings, from which the following extracts are made:

The time of beginning was about 5:20 P. M.; time of passing nearly ten minutes; direction S. E. E. Breadth of track 20 to 40 rods. The bounds of its track are well defined on ridges, but the storm did not make a clean sweep, and many fields of grain in the track are left standing, apparently uninjured. The storm evidently passed most easily over the valleys, and was apparently turned from its course by high ridges or strong buildings surrounded by dense groves, as at Lake Side and beyond. At the Lake Side farm it whirled through an opening where are the cattle yard, sheds and cribs, which were demolished, but left the strong buildings, and was borne over the dense grove beyond, taking the tops of the scattering tall trees only. So Storm Lake may have escaped, the lake surface being taken as a course of less resistance.

The tornado did not hug the ground closely, but there are many places both west and east of the lake where the effects of the irresistible whirlwind are evident, and the currents were strong enough to lift and carry away light buildings, particularly such as stood in the openings or on the edge of a heavy grove, around which the storm curved in great violence. In several places the groves seem to have borne up the storm and carried it over by their density and elasticity, and they are now standing green and unscathed, while scattering trees are destroyed. The storm as it passed over the lake is described as a rolling cloud of dense blackness.

The trailing appendages, which news reporters have pictured, were not observed here, and I am of the opinion that there may be tornadoes without them. And if in future I see a black cloud approach against the wind, with roaring and thunder, followed by a moment of calm, I shall be apt to drop into a hole, or flee to a cellar, and not wait to look for a tail.

As the storm approached all low clouds, east and north, seemed driven rapidly toward the point of loudest thunder. The thunder was heard first in the northwest, then as the storm cloud passed in the southeast, and last very distant in the east. At about 5:30 observer went indoors, listened to the thunder and roaring, noted the hail and rain, and the changes of wind from brisk east to calm, then quickly to strong gusty southwest, west and northwest, and back to light east. But we did not know there was a tornado till later.

The scorched appearance of trees, attributed by one writer to electricity, I observed carefully on some maples standing in a fence row. The trees were not broken, but twisted and bent so as to loosen the outer bark, which had been taken off by the wind and carried away, the

inner bark left presenting a yellowish brown, which is its natural color, while the leaves of the trees were whipped and torn to shreds and dried, the stems still adhering to the tough, unbroken twigs and the whole tree, body and top, presenting the appearance at a distance of having been singed, though on close inspection it was evident that nothing of the kind had happened. Many other trees which had received a sand-blast from the lake beach, presented a similar appearance.

At Lake Side Farm the tornado encountered the hill, grove and buildings, and was turned from its course to nearly southeast, passing the east lake bluff through the valley of the lake "outlet." In crossing this bluff ridge the whirlwind seems to have been raised and passed over the corn fields on the east side, doing little damage, but only moved one barn, which stood on a high point, and trimmed some trees on another ridge.

In many places along the line the storm seemed to have changed its course to avoid obstacles for other lines of less resistance, and then to have returned to its general direction. And I would suggest that a survey might be made of the whole track for the purpose of determining the safest locations for buildings in general, and what artificial safeguards may be placed around them and used in their construction.

If a tornado can be lifted up and passed safely over a farm house by a proper arrangement of groves, it would be well for the public to know it.

No doubt there are many ways of protecting our buildings from the devastating tornado, which we may learn only by carefully observing and respecting and acting upon God's laws as shown in natural phenomena.

The Storm Lake *Pilot* says: "The storm as viewed at Storm Lake was about forty rods wide and almost black darkness enveloped its path, while a few miles south or north the sun was shining. James DeLand sat in his buggy in the sun four miles south and watched the cloud pass between him and the city. F. M. Curtis reports that he stood near Fisher's Casino and watched the cloud until it reached the Chamberlain place, and then hastened to the cellar, the death-dealing tornado passing a few rods north. The storm began near Quimby, in Cherokee county and its course was east by a little southeast. There several people were killed. It entered Buena Vista county on the line between Nokomis and Maple Valley townships, but did no extensive damage until it reached the farm of Geo. Baker, Sec. 33, Nokomis; here it swept away his barn and killed some stock.

OTHER REPORTS.

Postmaster Blair, of Newell, writes that the storm passed about one mile south of that place, at 6 P. M., destroying buildings, groves and crops in its path, injuring several people.

W. L. Thompson, of Manson, writes that the storm began in the southwestern part of Cherokee county and ended about four miles west of Manson, in Calhoun county (about four miles east of Pomeroy). The day was close and sultry, no air stirring, the mercury at 2 P. M. at 90°. About 4 P. M. heavy clouds showed up in the west and northwest. The dark bank was preceded by scud clouds. As the cloud bank advanced the center of it, northwest of Manson, and about on a line with Pomeroy, took on a green color. The tornado struck that place at 7 P. M., and spent its force there in three to five minutes. A light rain preceded it about five minutes.

It seemed to strike the earth, slantingly from above, crushing everything beneath it, then rising with a whirl, scattering the wreckage in all directions, one part of a house being blown to the south and another part west. The direction of the wind all day had been from the southeast. Violent thunder and lightning accompanied and followed the tornado, and heavy rain fell over a half hour afterward. All appearances in Pomeroy indicated a tornado, while two miles east it looked like a straight blow. The death roll at Pomeroy and immediate vicinity was 48 (on the 10th inst.) and the wounded in hospital or under care of surgeons, numbered 75. The area of total destruction in Pomeroy is about one mile east and west, and from one-fourth to one-half mile wide.

Observer H. B. Strever, of Larrabee, reports that the tornado formed three miles west of the center of the southern half of Cherokee county, or about the center of the southern tier of sections in Rock township. That would extend the track three miles west of dark line in Fig. I, which was made before the receipt of this report. It is probable, however, that the storm was not fully developed until it reached Pilot township, where its destructive effects were first noted.

THE SCENE AT POMEROY.

The Director visited the stricken town on the day following the disaster, and again on the 14th, accompanied on the latter date by Dr. Geo. M. Chappel, Local Forecast Official of the United States Weather Bureau, and Assistant Director of the Iowa service. A careful inspection was made of the debris and other visible effects, to determine, so far as possible, the nature and special characteristics of the storm which wrought such appalling destruction in so short a space of time.

In Fig. II we have a photo-engraving from a pencil sketch, showing a plat of the town, the area of total or partial destruction being indicated by the dark lines, which are also made to show the direction of the wreckage of buildings, trees, sidewalks, etc. The arrows, in line with the debris, show the direction of the air currents which formed portions of the whirling column. The long arrow, pointing southeastward, is at the center of the belt of total destruction. The town plat contains, as will be seen, about thirty blocks south of the Illinois Central Railway. The business houses are mainly located between First and Second streets, nearly all the private residences, together with the churches and school house, being south of Second street. From this statement it will be seen that eighty per cent of the residences were destroyed or rendered uninhabitable. Fully twenty blocks were swept clean of human habitation or other buildings, nothing remaining but the debris, as shown in the engravings, Figs. III and IV, and a few mounds above the caves wherein many lives were saved. The

blocks of the town are about 300 feet wide, and the streets the usual width. From this it will be seen that the average width of the belt of complete destruction is about 1,200 feet; and the track of total and partial destruction is 1,800 feet.

The force of the storm was evidently much greater at the right than at the left of the central line. The fact

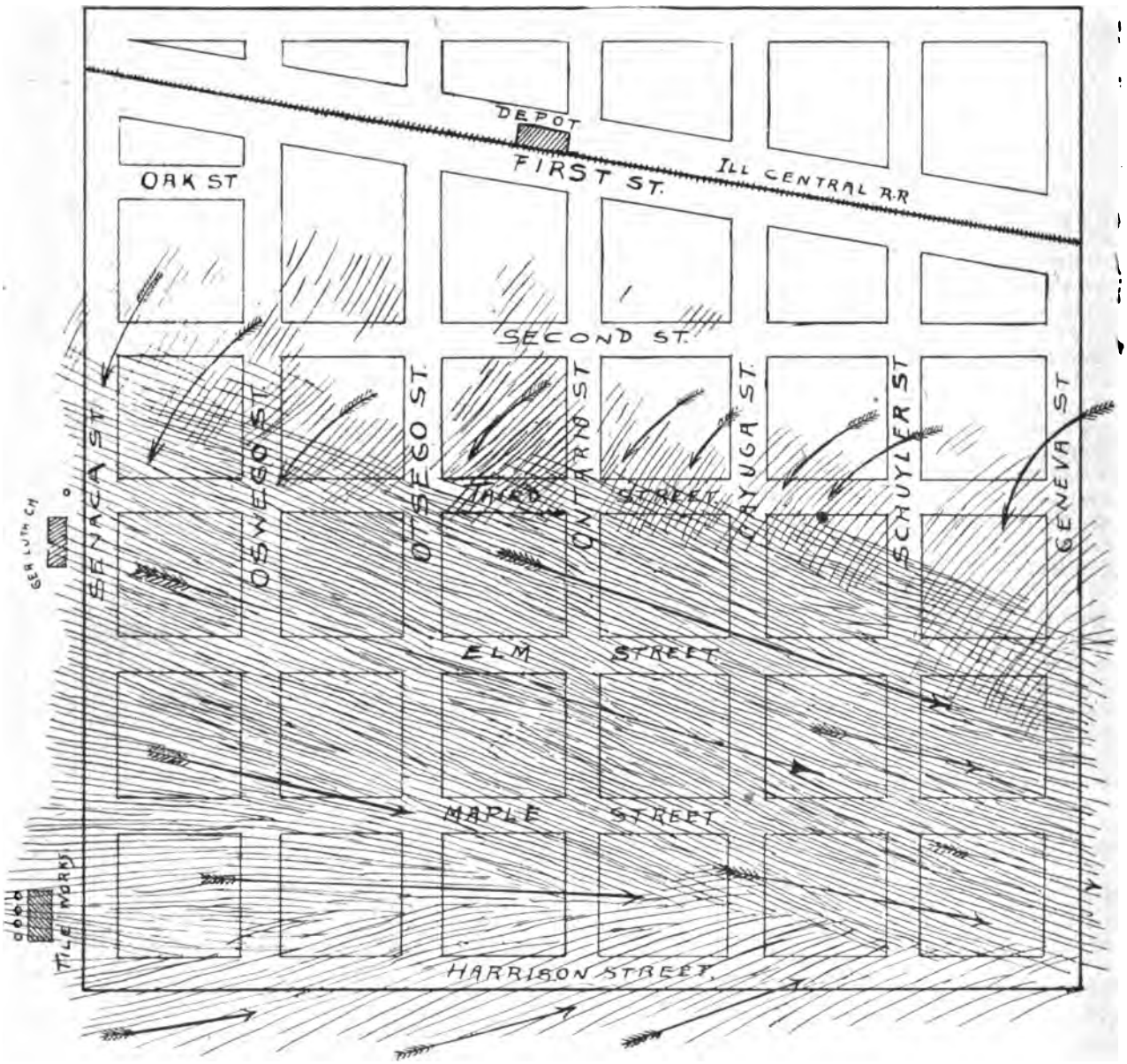

FIG. II--PLAT OF POMEROY.

should be noted, however, that the southern portion of town did not contain as many residences to the square as did the central and northern tiers of blocks. Fig. III, which was photographed from the center of the belt, looking northeast, gives a general view of the area of total destruction, and the distribution of debris, and also shows a fringe of partially wrecked houses on the north.

Fig. IV was taken from a point of view on the north side of the storm's path, looking toward the southeast, showing the wrecked school house in the foreground. The school house was evidently unroofed; the sides were blown outward and the upper floor was broken on either side of the central partition, the bulk of the wreckage being carried towards the south. The west tower was demolished and the steel bell, weighing 200 to 300 pounds, was carried a distance of two blocks to the northwest.

On the left of the central track (north side) all the wreckage of buildings, sidewalks, trees, etc., were carried to the southwest, on the line shown by the arrows in Fig. II. At the northwestern point, where the storm first struck the town, a residence was pushed bodily six rods to the

southwest, over trees and shrubbery, scraping the sod as it went, forming a bank of earth on its south side three feet high. A little over a block south of it stood the German Lutheran church, the largest and strongest structure in town. That was blown in pieces, and most of the debris was carried towards the northeast. At the extreme east of the town plat, near Third street, stood the Catholic church. An intelligent resident states that he saw that building lifted up bodily in the air, whirled around and then dashed to the earth. The wreckage is strewn towards the southwest. A little south and east of that building stood another smaller church, which was wrecked and blown towards the northwest. On the extreme south side of the path of the storm houses were moved and loose debris carried towards the northeast, as shown by the lines and arrows in the diagram. In the central belt the smaller debris, and in fact all forms of wreckage, were found distributed on the direct line of the storm. This fact led some reporters to the conclusion that the greater work of destruction was done by a straight blow from the northwest. There was quite likely a straight wind of hurricane force following directly in the wake of the revolving shaft of destruction, and that wind undoubtedly had a part in the distribution and direction of the debris. On the flanks, however, the same degree of uniformity is not visible.

The trees on the flanks, and the few gnarled and twisted trunks of trees and shrubbery left in the center of the track, all bore mute testimony as to the character of the storm. On the left they were partially denuded of bark on the north or northeast sides, and the broken or uprooted trees pointed to the southwest. On the right flank reverse effects were seen. And in the central portion of the track the stubs and trunks were almost wholly divested of bark, and bore the scars of contact with a great variety of flying missles from all sides. In many cases the bark must have been ground off by attrition, the stubs being too heavy to have been peeled by twisting. By the same attrition fowls were divested of their feathers, numbers of which were seen in the debris. The human victims of the tornado's fury, the dead and wounded, bore evidence on their persons of the fact that the air was filled with an infinite number of swiftly moving splinters, sand, mud, plaster, limbs of trees and other movable objects. In fact, some of them were literally tatooed.

The business part of the town was not left unscathed. The brick drug store of Mr. Mullen, near Second street, fronting east, was badly wrecked. The glass front was broken in by the strong current from the northeast, and the entire south wall, a foot thick, was blown over to the southward. Another brick store in the next block east was also demolished.

FIG. III.

The value of caves was well attested by this storm. Seven or eight of these places of refuge in the devastated district sheltered forty to fifty people, protecting them from all harm. They are cheap and frail looking for the most part, built necessarily mainly above ground on account of the damp and undrained nature of the sub-soil, covered with mounds of earth rising four to six feet above the surface; and yet they admirably served their purpose as tornado-proof structures. If every family had been provided with such a place of refuge, and had heeded nature's danger signals, no fatalities would have been recorded. Their cost is trifling, and at such a time a very poor hole in the

ground is worth more to a family than the richest gold mine in America.

The cellars of Pomeroy afforded a measurable degree of protection to those who made timely flights thereto. We made dilligent inquiry, but heard of no well verified instance of fatal injury to people who took refuge in their cellars, but many were bruised by falling debris, or pierced by flying splinters, and few came out of the cellars wholly unscathed. Observing the amount of stones. brick, wreckage of furniture and other debris piled in the cellars, it seems a miracle that any person came out alive. Near the center of the track we were shown a cellar eight by twelve feet wherein a woman and two children were saved from serious harm, and yet while they were crouched near the door at the west wall, a stallion weighing 1,600 pounds was blown in from the east side and remained floundering in its death struggle until the storm had passed and the people were rescued. Columns could be filled with narrations of miraculous escapes, and other columns with the sad details of death and suffering.

The death roll at Pomeroy and immediate vicinity amounted to forty-six, according to our latest verified report. The fatalities along the entire line of the storm number over seventy. In this respect it was the most destructive storm that ever visited Iowa.

NOTES AND OBSERVATIONS.

Indications of the uplifting force of the tornado have been noted at all points. It has been stated that in passing over Storm Lake it lifted a column of water 100 feet high. This must be taken with a grain of allowance, for no one was near enough to its track to discern the column through the mass of vapor accompanying the storm. But the fact is well attested by reliable eye witnesses, that while the storm was crossing the lake the waters at the north shore receded rapidly, a hundred feet or more, leaving bare ground at the pier where the small steamboat lands. After its passage the waters rushed back with a tidal wave several feet high.

FIG. IV.

A great number of intelligent people, who were near the path of the storm, testify to the fact that light structures were lifted many feet, whirled around in the air and then dashed to the earth. In some cases they saw, or thought they saw, buildings whirled over and over, somersault fashion, as if the revolving column had for the moment whirled on a horizontal axis.

Near the center of the track in Pomeroy a number of buildings evidently exploded outward, from the force of the expanding air within, the roofs being carried away, and the sides and ends of the structures were left lying as they fell, towards the four points of compass. On the

north of the track, in the area of partial destruction, the buildings bore striking evidence of the expansive outrush of air towards the south. Parts of roofs were carried in that direction, and windows were broken from the force within, the glass being carried outside. Numerous houses were seen partially wrecked, their southern sides or wings being blown towards the track of the tornado. There seems to be no room for doubt that the main destructive force in this storm was its tremendous uplifting power.

As to the roaring sound of the storm there is abundant testimony. One man whose family were saved in a cave, remarked, as he urged them to flee, that it was either a very bad storm or a very heavy train of cars coming. It proved to be the former.

Postmaster Mallory, of the town of Jolley, five miles south of Pomeroy, writes that the loud roaring noise was distinctly heard at his place. In his description Mr. Mallory says the advance part of the cloud, as it approached Pomeroy, was rolling over and over, parallel with the ground. This was closely followed by two funnel-shaped masses swiftly revolving, the clouds from the southeast being drawn towards the center. The lightning and thunder were unusually violent.

The total property loss occasioned by this storm has been variously estimated, in some cases with great exaggeration. In the town of Pomeroy something over one hundred residences were destroyed or badly wrecked. Some of these were quite valuable, but the majority of homes destroyed were worth from $600 to $800 each. The average individual loss did not much exceed $1,000, and it is probable that a thoroughly accurate appraisement would show that the total loss in Pomeroy was about $175,000. The bulk of the sufferers were comparatively poor people, whose entire savings, except their lots, were swept away. These cases appeal to the generosity of the prosperous people of Iowa, and we are glad to note that liberal response has been made. The total property loss along the entire line of the storm was probably about $225,000. In the majority of cases the farm losses were partially covered by tornado insurance. About 20 per cent of the buildings destroyed in Pomeroy were insured.

All in all, it was a notable storm, and we hope never to see its like again in our fair State. The writer is indebted to the postmasters at Aurelia, Sac City, Jolley, Newell, Fonda, Storm Lake and Pomeroy for valuable data relating to the storm. Only a portion of the mass of notes in hand could be used in this report.

IOWA CROP REPORT, AUGUST 1.

During the month of July there was a rapid advancement in the condition of corn, and on the 1st of August the reports of the crop correspondents of this Bureau show an average condition of 101 per cent, making comparison with the normal or average of the crop. Since August 1st the severe droughty weather somewhat lowered its prospects, but it is hoped that recent showers will give renewed promise of a full average yield of corn.

Winter wheat has been harvested and mainly threshed. Its condition was rated at 87 per cent, making it about up to last year, when the average per acre was fourteen bushels. The State has about 235,000 acres of winter wheat, giving a total of 3,290,000 bushels. There was an increase of about 43,000 acres this year as compared with 1892.

Spring wheat is rated at 76 per cent, and threshing returns show that this grain was badly shrunken by rust and blight. The estimated acreage of spring wheat this year is 621,305 acres. The average yield cannot exceed eleven bushels per acre, much of that of light weight. This would give a total of 6,834,355 bushels. This added to winter wheat would make our total wheat product 10,124,355. Later returns from threshers may somewhat change these figures.

Oats have made a bad showing from a fairly promising start. The average condition in the State is 67 per cent. In many sections the output falls below half a crop. In others it comes well up to an average. It is doubtful if it finally turns out to be two-thirds of an average in the State. The area sown this year was probably near 4,000,000 acres. The average per acre is not likely to exceed twenty bushels. This estimate may be changed by later returns, but not materially.

Other crops are rated as follows: Broom corn, 92 per cent; sorghum, 89; rye, 84; barley, 90; flax, 92; buckwheat, 90; potatoes, 80; sweet potatoes, 88; millet, 90; apples, 46; grapes, 96, and pastures, 86.

EDITORIAL NOTES.

When the tornado demon howls, "I'm coming!" the wise man says, "I cave."

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The Clinton *Age* says: "Hay is a big crop in Iowa, and this year's crop put in stack will be worth not far from $45,000,000." The shortage of fodder crops in Europe, the *Age* thinks, will help Iowa farmers to get rid of some of their surplus at remunerative prices.

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A press dispatch dated Aberdeen, S. D., July 19, gives the following cheering news to our sweltering people:

"The International Cold Wave company, with a capital of $6,000,000 and a surplus of one-third of that sum, has been organized by local capitalists and enthusiasts, who expect to make untold wealth in the next few years. The company has discovered a secret, the potency of which, if applied at the right time, will vitiate and destroy the hot winds which arise in Kansas, and at times have been known to sweep this country, burning and killing the growing crops. This secret will be placed on sale and revealed to the residents of townships, counties and other political divisions who put up the money. When the wind is blowing hot and strong from the south, the company will undertake to bring a counter-wind from the ice

field of the frozen north. Just what process has been evolved, or to whom the marvelous discovery is to be attributed, are not matters for publicity."

This latest scheme to "raise the wind" is a legitimate offspring of the rain-making projects which have been worked by the shrewd men in the semi-arid regions of the west. We have fully as much faith in the one scheme as in the other. If men can milk rain from cloudless skies, they certainly ought to be able to import cooling breezes from the north to temper the hot winds to the shorn lambs of the plains.

***

When you see a tornado get in on the ground floor.—*Sioux City Journal.*

You had better get off the ground floor and dig under ground as far as you can go without suffocating.

***

A Leavenworth, Kansas, special, states that on the 19th of July at 3 A. M., when the sky was clear and stars in full view, a rain fell for about 15 minutes—a phenomenon never before recorded in that region.

***

A correspondent of the Grinnell *Herald* says: "A well constructed cave and a reliable barometer will pay their cost in the sense of security they afford. With this equipment much of the nervous prostration so prevalent might be avoided. To spend the night in a cave with the barometer above 29 inches, as many have recently done, is an insult to that instrument, as well as a great waste of vitality."

This contains a wise suggestion. Without doubt a well constructed cave or "bomb proof" shelter in a cellar will pay the cost of construction by affording a sense of security to a nervous family, though they may never have occasion to use such a place of refuge. And a reliable barometer in the hands of one who can interpret its readings, is worth a vast deal, both as a monitor and a comforter. But its reliability should be tested by comparison with standard instruments. When its observed reading (not reduced to a sea level) is above 29 inches, the storm cave will not be needed. And, we may add, there is never occasion to spend a night in such a place, for the tornado is seldom a night prowler. Heavy squalls may occur at any time of night or day, but the twister is usually an early evening visitor, coming in advance of the rain, or very shortly after the storm clond arrives. People should exercise due caution in heeding the portents of dangerous storms, but it is best not to be killed by worry over the possibility of being killed by a tornado.

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The lot of the Western rainmaker is not entirely a happy one. Some weeks ago a serious cloudburst occurred in Lyon county, Kansas, destroying the wheat crop of Mr. James Butler, a farmer of that county. A few days later A. B. Montgomery, a rainmaker at Goodland, Kansas, claimed to have caused the cloudburst, and Mr. Butler has now brought suit against Montgomery for the value of the destroyed crop. The same storm caused a washout on the Santa Fe road, which resulted in a wreck in which an engineer was killed, and the wife of the deceased proposes to bring a suit against the originator of the cloudburst for $10,000 damages for killing her husband. If gentlemen will assume control of the forces of nature and scatter cloudbursts, cyclones and other meteorological phenomena promiscuously throughout the country, they must do it with a clear sense of their responsibility. If scientific rainmaking should become a demonstrated fact it will still have to meet the obstacle that it must obtain "unanimous consent," under penalty of damages to any one injured by a rainstorm to which he has not agreed, Unanimous consent is somewhat difficult to obtain. because men will not think alike.—*The Homestead.*

***

The Iowa State Fair this year will undoubtedly exceed any former exhibit of the State Agricultural Society, and judging by present indications, it will be well patronized. It begins September 1st and continues to the 8th.

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The *Arizona Weather Magazine*, a monthly publication devoted to the climate and resources of the Territory of Arizona, is a welcome addition to the exchanges of this office. It is edited and published by W. R. Burrows, director of the Arizona Weather Service. It is a handsome and readable publication.

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We hope to welcome a goodly number of crop correspondents and voluntary observers at the State Fair September 1-8. Call at Weather Bureau headquarters.

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Prof. Lorin Blodget, of Philadelphia, author of "American Climatology," writing to the director of this service, under date of July 11th, says: "I am sorry to see the extreme destructiveness of the season generally since summer weather began. Within a few days we had a destructive tornado in this city, attending several others, all local ones, in eastern Pennsylvania." So it appears that tornadoes are not altogether sectional in their visitations. Some of the most destructive storms on record have occurred in the eastern half of the United States.

***

The Nebraska Weather Service, under the directorship of Capt. Geo. E. Hunt, U. S. Forecast Official at Omaha, has begun the issue of a monthly magazine entitled the *Nebraska Weather Record and Monthly Crop Review.* It is an interesting publication, well worthy of the support and patronage of the people of Nebraska. Official facts and figures relating to the climate of that State constitute the best advertisement that can be sent abroad.

***

There is a scientist at Washington who proposes to "get right into the business end of a tornado and find out its secret power." It is quite possible he might gather the information, but there would likely be considerable delay in sending back account of his discovery.—*Chariton Herald.*

***

Observer H. W. Vandike, of Belle Plaine, sends a very fine sample of "Turkish Red" winter wheat raised on the farm of Arnold Casselberg, of Iowa township, Benton

county. Mr. Vandike says: "The yield was 27 bushels, machine measure, to the acre. One half bushel, machine measure, weighed 33 pounds. Thirty-five years ago it was no uncommon occurrence to raise 30 bushels of spring wheat per acre, but of late wheat raising is almost a lost art. I send you the sample to show what skill, energy, and good farming may yet accomplish in the way of winter wheat culture."

FUEL SUPPLY OF IOWA.

BY DR. CHARLES R. KEYES, ASSISTANT STATE GEOLOGIST.

It was the discovery and use of fire that raised primeval man above his brute companions. Ever since that early, prehistoric time, fire has been among the foremost of factors in the advancement of the human race, until to-day it forms the one great element of man's material progress.

Possessed, in its childhood days, of a force so subtile, so powerful, little wonder is it that mankind should have felt so deeply such an influence; an influence pervading all its doings, entering every act of its daily life, and directing even its spiritual course. The hidden powers of fire, its magic effects and marvelous results, ranked it with the early races among the forces supernatural. Fire, therefore, in its seeming potency so far beyond that human, early became an object of worship. Before it whole nations prostrated themselves trembling, and offered up their prayers. It was regarded as the giver of all life. The human soul itself was thought to be identical. With the literatures and philosophies which are coupled with the dawn of history, fire has a prominent place. The Vedas taught of its guiding influence in the daily conduct of man. Among the Aztecs it was the oldest of divinities, the parent of all gods. With the North American Indians it held an important place in the religious ceremonies of many tribes.

For a long period after man began to be a fire-using animal all the necessary fuel was supplied by the surrounding forests. But as these commenced to disappear rapidly with the advance of civilization attention was turned necessarily towards new sources for furnishing heat and light. Mineral supplies were naturally looked for as the living vegetable stores became exhausted. Thus the stored up carbon of by-gone ages began to be drawn upon. From the burning of the woods and charcoals man rapidly changed to the use of mineral coals.

"Coal," says Newberry, "is entitled to be considered as the mainspring of civilization. By the power developed in its combustion, all the wheels of industry are kept in motion, commerce is carried with rapidity and certainty over all portions of the earth's surface, the useful minerals are brought from the deep caves in which they have hidden themselves, and are purified and wrought to serve the purposes of man. By coal, night is, in one sense, converted into day, winter into summer, and the life of man, measured by its fruits, greatly prolonged. Wealth, with all its comforts, the luxuries and triumphs it brings, is its gift. Though black, sooty and often repulsive in its aspects, it is the embodiment of a power more potent than that attributed to the genii in oriental tales. Its possession is, therefore, the highest material boon that can be craved by a community or nation. Coal is also not without its poetry. It has been formed under the stimulus of the sunshine of long past ages, and the light and power it holds is nothing else than such sunshine stored in the black casket, to wait the coming and serve the purposes of man. In the process of formation it composed the tissues of those strange trees that lifted up their scaled trunks and waved their feathery foliage over the marshy shores of the carboniferous continent where not only no man was, but gigantic salamanders and mail-clad fishes were the monarchs of the animated world."

Being one of the prairie states with a situation on the borders of the "Great Plains," having a surface with no marked contrasts of altitude and possessing a soil unrivaled in fertility by that of any country on the face of the earth, it has been customary to regard Iowa as a strictly agricultural province. Annually the State compares herself with her sister states and the countries of the world as to her rank in supplying various farm products. She finds that as a producer of corn, oats, potatoes, hogs and horses, she stands first on the list among the states of the Union; of flour, barley, oats and hay, second, and correspondingly high in other products. She immediately concludes that she is a great farming country; and, indeed, she is. With more than 35,000,000 acres of areable land the total valuation of her farm products every year is nearly half a billion of dollars. With just pride the "Queen of the Prairies" commands the attention of the world to her agricultural wealth and capacities.

But in a moment of righteous enthusiasm, the fair State has all but forgotten that she has other resources as boundless as those she has extolled. Resources which half the Nations of the globe would consider untold worth if they did but possess them. Riches which nature has bestowed with lavish hand. Wealth which can only hasten the onward progress of humanity. These resources are the mineral resources. They are the inherited possessions which are bound up in the coals, the clays and the metallic ores.

Foremost among these natural products are the deposits of coal. The coal field of Iowa embraces upwards of 20,000 square miles. Fully one-half of this area may be considered as underlain by workable coal, much of it by several beds, so that it is safe to say that there are not less than 10,000 square miles or nearly one-fifth of the areal mileage of the State, which may be regarded as capable of supplying coal in quantities of commercial importance.

It has been seen that in the case of her agricultural products Iowa enjoys making comparisons with other states and countries. Curious as it may seem, however, Iowa has allowed her mineral industries to take care of themselves. In the half century of her existence as a State she has extended but little aid in developing her greatest sources of mineral wealth. Her lead deposits which once afforded the chief supplies of this country are now scarcely noticed. Her zinc has received but little attention. Her iron ores have not been investigated.

With clays enough of all kinds to supply the world for untold ages, she has purchased the manufactured products from other states.

These comparisons are not instituted here to depreciate Iowa's mineral capacities; far from it; they are made rather to show that there lies within her boundries latent resources and undeveloped possibilities, the extent of which has not been suspected heretofore by the majority of her citizens, and the character of which has been entirely unknown to people of other states.

In her coal she has been somewhat more fortunate, for as a producer she ranks to-day first among the states west of the Mississippi and fifth among the states of the Union.

A glance at the nations of Europe shows that if they were arranged in order as they are powerful and prosperous, their respective ranks correspond in a general way with the amount of coal each of them produces, for upon this fuel depends largely the manufacturing industries.

The latest returns from Europe indicate the annual coal product to be, in round numbers, for

Great Britain	190,000,000	tons.
Germany	85,000,000	"
France and Belgium	45,000,000	"
Austria	9,000,000	"
Russia	6,000,000	"
Spain	1,000,000	"
Italy	400,000	"
Sweden	300,000	"

England, the richest and most powerful of European countries, owes her high position almost entirely to her manufactures; and from her little island she has extended her possessions around the globe. The annual coal production of Great Britain is now in the neighborhood of 200,000,000 tons. As recently estimated by a leading authority, "a very short calculation will suffice to show what an important contribution this makes to her national wealth. The power developed in the combustion of a pound of coal is reckoned by engineers as equal to the power exerted by a man of ordinary strength during a day of labor; so that a pound of coal may be regarded as equivalent to a day's labor of a man. Hence, three hundred pounds will represent the labor of a man for a year. It was estimated some years ago that upwards of 20,000,000 tons of the annual coal product of Great Britain are devoted to the development of motive power, and that this is equivalent to the labor of 133,000,000 men. These men, in this calculation, are considered as exerting merely brute force; but since they may all be regarded at producers only, and not consumers—the profit on the balance of her coal product fully covering all expenses—we are safe in estimating the contribution made to the wealth of Great Britain, by her annual coal product, as equal to that of 133,000,000 skilled operatives laboring for her enrichment." Now England has an area about the same as Iowa. The United Kingdoms have coal fields which approximate 10,000 square miles, which is the estimated extent of Iowa's coal-bearing territory, counting on a basis that only one-half of her entire carboniferous area is capable of producing coal in commercial quantities. Great Britain has, of course, a much larger population, and is near the densely populated districts of the continent. She may also have a somewhat larger quantity of coal included in her rocks than Iowa; but granting all this, the discrepancy cannot be at all near what the difference in the annual production of the two districts would indicate, for Iowa's is only about one-fortieth that of England. It is also to be remembered that there is no deep mining carried on in Iowa. Rarely do shafts penetrate more than 125 or 150 feet. In the Lancashire coal field of England pits are sunk to a depth of 2,800 feet, and in the Somersetshire and Durham regions 1,500 to 2,000 feet are not uncommon depths. Some of the Belgian pits have been carried down 3,400 feet. While it is not probable that these great depths will ever be reached by the shafts of this State, there is abundant reason to believe that in many portions only the surface coal has yet been reached. With deeper mining Iowa is certain to increase immensely her coal supplies. Indeed, in a number of places which have been regarded as territory completely "worked out" the penetration of only fifty feet deeper has rekindled the industry with vigor far greater than ever before.

Germany contains the celebrated coal fields of Searbruck and Westphalia, besides a number of minor importance, embracing altogether possibly 3,000 square miles. The coal-bearing rocks of the Ardennes in Belgium and the north of France, and of the St. Etienne field of the central plateau of France, together with numerous smaller areas aggregate only about 2,500 square miles. The other countries of Europe, with the exception, perhaps, of Spain, have coal areas very much smaller still.

Coming back now to Iowa she is found to possess coal fields whose areal mileage exceeds that of the greatest of European nations, surpasses by three, four or many more times the total area in many in any other of the great countries of the eastern hemisphere. To be sure the geological conditions in the British Isles for instance has not been exactly the same as here and England perhaps has in the aggregate greater deposits of the mineral fuel than Iowa but the fact still remains that Iowa has latent mineral wealth within her boundaries which has never been appreciated anywhere near to the extent that it should be. Besides, if there is anything which should be especially emphasized in connection with the present investigation it is the fact that the actual supply of coal in Iowa is many times greater than it has been usually considered and that she is almost infinitely richer in this regard than it was possible even to estimate before some definite information on the subject had been collected. Instead of single coal horizons, or two or three perhaps as in some cases, six, eight and even a dozen have been recognized at single locality. A single example will suffice. In Polk county it is the opinion of many that the coal is "practically worked out". Not three seams as commonly recognized, but half a dozen or more distinct beds have been made out. It would doubtless be a conservative estimate to say that the amount of workable coal now in the county is equivalent to a bed not less than four feet thick over every square mile of its area. This, and only the upper or surface one-third of the vertical depth of the coal-bearing strata yet explored.

Certainly Iowa has not suffered by the comparison of her posibilities in coal wealth with that of other regions.

STATE WEATHER SERVICE CONVENTION.

A communication has been received at this office from Major H. H. C. Dunwoody, Assistant Chief of the U. S. Weather Bureau, and President of the American Association of State Weather Services, calling a convention of that organization, to be held in Chicago, August 21-25. All Voluntary Observers of the Iowa service are entitled to membership, and they are cordially invited to meet with that body at the time and place mentioned in the call. Those who intend to visit the World's Fair should, if convenient, arrange to be there during the sessions of that convention and the World's Meteorological Congress. Following is Major Dunwoody's official notification.

SIR:—After consultation with the Chief of the Weather Bureau, it has been decided best to hold the convention of the American Association of State Weather Services for 1893, in Chicago (not at Madison, Wisconsin, as was expected), at the time and place of the meeting of the Meteorological Congress at the Art Palace of Chicago, Lake front, foot of Adams street, in that city, August 21-25, 1893. I am authorized to state that when practicable leaves of absence will be granted to Weather Bureau members of the Association of State Weather Services to enable them to attend the meeting, and the Chief of the Weather Bureau will also recommend that assistance be allowed for the performance of station work during the absence of those attending the convention,

H. H. C. DUNWOODY,
President American Association of State Weather Services.

TOPICS FOR DISCUSSION.

1. Inspection of stations of observation and display stations annually, to form the acquaintance of observers and displaymen and to instruct and encourage them in their work.

(*a*) Importance of location of instruments and elevation of instrument-shelter above ground.

(*b*) Instruments and shelters to be supplied by the Weather Bureau.

2. The necessity of sufficient weather-crop correspondents to make the data in weekly weather-crop bulletins thoroughly reliable.

(*a*) Time of day of issue of the weekly bulletins: Should they not be issued Tuesday afternoon, and is it not advisable to manifold sufficient copies for the press of the State by means of the milliograph process?

(*b*) The best method of printing the weekly bulletin, and at whose expense.

3. Uniformity in method and class of data published weekly and monthly.

4. Importance of directors and assistants in charge making a special study of the crops grown in the State. Since the majority of states have experimental stations, and that these stations are also voluntary stations, should not the date of inspection of such stations be prolonged to several days so as to give the student time to learn the important details connected with the growth of the several crops, etc.?

5. Value of an annual convention of the voluntary observers, displaymen and weather-crop correspondents in each state some state fair day, or at such time when the people of the state are drawn together.

6. Is the work of the director or assistant in charge of a state service of such magnitude as to make his duties as local forecast official or observer in charge of station too onerous to give him the time to do as well for his service as he could do if he had only the duties of director?

7. Relation of state weather services to experimental stations and what will improve them.

8. The necessity for more accurate measurement of snowfall.

9. The value of frost predictions and the best method of making them locally.

10. Methods of protecting tender crops from frost.

JULY WEATHER REPORT.

The month of July, 1893, was hot and relatively dry. The mean temperature for the State, 75°, was about 1.5° above the normal. The proportion of sunshine was unusually large; the days were hot, but the nights were relatively cool, serving to mitigate the fervency of temperature.

The average rainfall, 3.33 inches, was slightly below the normal amount. Its distribution is shown by the chart. In general it was ample for the crops.

The following table gives, as a basis of comparison, the mean temperature and the total rainfall for the month of June, at the stations named, for the years from 1872 to 1893, inclusive:

YEARS.	MEAN TEMPERATURE, DEGREES.						PRECIPITATION, INCHES.					
	Des Moines.	Davenport.	Dubuque.	Keokuk.	Omaha.	Sioux City.	Des Moines.	Davenport.	Dubuque.	Keokuk.	Omaha.	Sioux City.
1872	....	76	..	78	76	....	....	3.80	....	6.77	6.36	.....
1873	....	75	76	76	75	....	....	2.37	1.27	7.73	4.24	.....
1874	...	78	78	80	80	....	....	3.10	3.24	4.61	0.54	.....
1875	....	74	73	76	74	....	....	3.36	5.74	12.70	10.02	.....
1876	....	75	75	77	75	....	....	4.82	8.15	6.79	7.30	... ..
1877	....	75	75	77	76	....	....	3.42	2.90	7.06	0.96	.....
1878	...	78	76	81	78	....	....	2.18	6.71	2.37	7.66	.....
1879	78	77	77	80	78	....	0.29	5.87	6.78	1.98	3.17	.....
1880	74	74	74	78	76	....	3.82	4.31	3.55	2.25	5.36	.....
1881	76	78	75	79	80	....	5.57	0.91	10.53	3.08	5.89	.....
1882	68	70	69	72	71	....	4.78	4.41	1.48	4.53	6.76	.....
1883	74	74	72	73	76	....	2.37	3.66	7.90	3.15	4.79	.....
1884	72	72	70	74	76	....	2.16	4.51	5.30	2.30	10.35	.....
1885	76	76	74	79	78	....	6.55	1.66	6.35	2.20	9.24	.....
1886	78	76	75	78	78	....	0.27	0.43	0.89	0.65	0.69	.....
1887	78	78	78	80	77	....	1.94	3.09	2.44	1.57	2.02	.....
1888	76	74	74	77	79	....	3.42	7.31	3.59	6.00	2.56	.....
1889	74	74	73	75	75	76	4.37	8.25	4.22	6.78	4.94	3.31
1890	77	76	75	78	79	76	1.10	0.85	1.21	2.49	3.74	2.59
1891	69	69	69	71	72	69	2.78	3.29	4.59	2.77	3.54	5.77
1892	74	74	74	75	76	75	8.64	4.16	5.08	6.18	3.64	2.63
1893	76	77	76	78	77	75	3.55	1.75	3.57	2.60	3.03	2.29
Means	75	75	74	77	76	74	3.44	3.83	4.58	4.26	5.08	3.32

SUMMARY OF WEATHER CONDITIONS.

BAROMETER—Mean pressure for the month, 29.95. Highest observed, 30.23 at Clarinda, on the 20th. Lowest observed, 29.64 at Sioux City and Cedar Rapids on the 6th and 14th. Range for the State, .59 inches.

TEMPERATURE—Monthly mean as determined from 68 Voluntary Observer's reports, 75°. Highest monthly mean, 81.5 at Washington; lowest monthly mean, 69.3, at

Sibley. The highest temperature reported was 102 at Atlantic and Ames on the 14th and 13th. The lowest temperature reported was 47°, at Sibley and Atlantic, on the 3d and 8th. Average daily maximum, 83.7°; average daily minimum. 62.9°; average monthly maximum, 95.2°; average monthly minimum, 54.4°; greatest monthly local range, 55°; range for the entire State, 55°.

PRECIPITATION—Average for the State as determined from 69 Voluntary Observer's reports, 3.33 inches. The greatest amount reported, 8.84 inches from Clarinda. The least amount reported, 1.49, at Oskaloosa. Average number of days on which .01 or more inches of rain fell, 7.0; average number of cloudy days 2; partly cloudy, 10; clear days, 19.

SOLAR HALOS—Blakeville, 27th.

TORNADO—At Alta on the 6th; Independence, 6th; Storm Lake, 6th. This is the same storm that destroyod Pomeroy.

HAIL—Clarinda, 14th; Delaware, 13th; Grand Meadow, 14th; Hampton, 14th; Jefferson 13th; Storm Lake, 6th; Spirit Lake, 13th; Sac City, 6th; Clinton, 13th.

AURORA—Alta, 6th; Tipton. 6th; Clinton, 15th.

THUNDER STORMS occurred quite generally on the 4th, 5th, 6th, 7th, 13th, 14th, 15th, 18th and 25th.

ATMOSPHERIC PRESSURE.

STATIONS.	Mean reduced barometer.	EXTREMES.			
		Highest barometer	Date.	Lowest barometer	Date.
Cresco	29.94	30.21	20	29.68	14
Clarinda	29.97	30.23	20	29.67	14
Cedar Rapids	29.93	30.14	20	29.64	14
Davenport	29.94	30.17	20	29.66	14
Des Moines	29.97	30.20	20	29.67	14
Dubuque	29.95	30.21	20	29.68	14
Keokuk	29.96	30.19	19	29.72	14
Omaha, Neb	29.96	30.20	20	29.66	5
Sioux City	29.92	30.16	9	29.64	6
Means	29.95	30.23	20	29.64	6–14

WIND MOVEMENT.

STATIONS.	Miles.	Maximum velocity.	Direction.	Date.
Davenport	5,302	38	W	8
Des Moines	4,981	32	SE	4
Dubuque	3,410	36	NW	8
Keokuk	3,636	36	W	4
La Crosse, Wis	4,343	26	NW	2
Omaha Neb	5,020	36	NW	15
Sioux City	6,252	46	SW	4

OBSERVERS' NOTES.

Clinton—DR. LUKE ROBERTS: July, 1893, was a very warm month, with an excess of sunshine. In fact it was the warmest July in fifteen years, save that of 1887, which went .4° higher, but whose number of clear days was one less and the per cent of cloudiness eight higher. The excess of heat for this month of 1887 was due to the unusual high maximum. It rose above 100° on five different days, four of which were consecutive, from the 14th to the 17th, inclusive. The highest temperature reached in July, 1893, was 95°, and there were sixteen days in which the maximum stood at 90° or above. The minimum temperature was 53°. This high minimum for July was duplicated only once previously during the last fifteen years. This was in 1888.

The peculiarity of July, 1893, was its unusual uniformity of temperature, and absence of sultry, breathless nights. There was no night uncomfortable for sleeping. save the undesirable environments of some sleeping apartments.

The warmest day of the month was the 7th, the mean temperature of which was 84.2°. This was 1.9° above normal.

The mean temperature of the coldest day was above that of any like days for July for the last fifteen years. The temperature was 71°. This was 7.6° above normal.

The mean daily range of temperature was 26.6°, being just normal. The number of storm days was only four, the 4th, 5th, 8th and 13th. The total precipitation was 2.26 inches. 1½ inches of this fell on the 13th.

On the 26th, 27th and 28th there was rain but not of measureable amount. During the storm of the 13th a heavy wind moving at a speed of thirty-six miles an hour prevailed between 8:30 and 9:30 P. M., doing some damage in the breaking of trees, etc.

From the 13th to the close of the month, no rain fell to gladden vegetation or replenish cisterns and small streams; but nature was kind in depositing copious dew nearly every night, which did much to keep the soil freshened.

Before the close of the month the need of rain was felt, and during the last ten days of the month fears were entertained that we were to be sufferers from a severe drought. These fears were not visionary, for rain was much needed in pastures and cultivated fields. Even an immediate rain could not save corn and potatoes from serious shrinkage in quantity and quality, but would check the impending disaster.

The total movement of wind was 2,590 miles. This was slightly above a July average. The prevailing direction was from the southwest.

Thunder and lightning played no conspicuous part in the phenomena of the month. The electric display was chiefly confined to the three principal rain days. Light hail occurred on the 13th and 16th.

A not very brilliant aurora was visible on the evening of the 15th from 8:40 to 10:30 p. m.

At the close of the month the depth of water in the Mississippi river was about three feet above low water mark.

Alta—DAVID E. HADDEN: Beautiful colored cloud effect with rainbow on evening of the 15th. Aurora Borealis on the 15th, first seen at 10 P. M. when clouds cleared away, a beam of greenish white light reached from near northwest horizon to past the zenith. After 10:50 P. M. the northern sky was the scene of many beautiful colored effects. streamers with dark segments, etc. The light faded out about 2 A. M. of the 16th.

Bonaparte—B. R. VALE: An ideal harvest and crop growing month combined. A little dry at end of month.

Cedar Rapids—H. D. OLDS: The month has been remarkable for almost continuous clear weather; but one day that could be classed as cloudy and three days as partly cloudy. The mean temperature of the month has been about 1.5° above the average for the past ten years at this station. Highest mean, 77.8° in 1887, and lowest, 70.4° in 1891.

The rainfall has been the lowest with one exceptlon (1886) when precipitation for July was only .57 of an inch. Greatest amount, 6.43 in 1885.

College Springs—A. A. BERRY: A spleudid month for the farmer. Corn never was a fairer prospect to excel in the greatest yield. The last half of month a little too wet for grain in shock. Wheat a very good crop. Hay good. Oats cut short by rust. Grasshoppers very numerous and doing some damage.

Fort Dodge—R. W. BLAIN: In July there were twenty-six clear days, three cloudy and two partly cloudy. Rainfall, 3.32 inches. Four rainstorms were accompanied by lightning and thunder.

JUNE METEOROLOGICAL REPORTS.

Reports from the following stations were received too late for publication in last month's review:

ALTA—Mean temperature, 70.8°; maximum, 89°, on the 12th; minimum temperature, 44°, on the 6th. Range, 45°; Wind, south. Rainfall, 5.48. Rainy days, 9; cloudy, 4; part cloudy, 9; clear, 7.

ESTHERVILLE—Mean temperature, 72.2°; maximum, 91°, on the 12th; minimum, 46°, on the 5th; mean maximum, 84.0°; mean minimum, 60.5°. Range, 45°. Wind, south. Rainfall, 1.77. Rainy days, 5.

KNOXVILLE—Mean temperature, 72.5°; maximum, 91°. on 13th; minimum, 51°, on the 22d. Range, 40. Mean maximum, 83.0°; mean minimum, 62.0°. Rainfall, 4.63. Wind, southeast. Rainy days, 8.

HOPKINTON—Mean temperature, 71.0°; maximum, 91°; minimum, 52°, on the 5th. Rainfall, 5.43 inches. Rainy days, 8.

GREENFIELD—Mean temperature, 71.2°; maximum, 90°, on the 13th; minimum, 46°, on the 6th; mean maximum, 83.5°; mean minimum, 59.1°. Range for the month, 44°. Wind, south. Clear days, 20; partly cloudly, 4; cloudy, 6; rainy, 9. Total precipitation, 3.08 inches.

METEOROLOGICAL DATA FOR JULY, 1893.

STATIONS.	TEMPERATURE OF THE AIR (IN DEGREES FAHRENHEIT).								PRECIPITATION IN INCHES.			Prevailing direction of wind.	No. of cloudless days.	No. of partly cloudy days.	No. of cloudy days.	No. of rainy days. (.01 inch or more).	No. of hail-storms.	No. of thunder-storms.
	Monthly mean.	EXTREMES.							Monthly.	Total monthly snowfall.	Depth of unmelted snow at end of month.							
		Mean maximum.	Mean minimum.	Maximum.	Date.	Minimum.	Date.	Monthly range.										
Algona	73.2	.....	.....	*94	22	*62	8	32	1.87	.....	.....	NW	22	9	0	7	...	...
Alta	72.9	84.8	60.3	93	25	53	3	40	4.61	.....	.....	S	17	11	3	11	1	9
Ames (W. R. Cooper)	73.2	86.9	59.6	95	14	50	3	45	1.62	.....	.....	.....	16	13	2	7	...	...
Ames (E. N. Eaton)	.....	.....	.....	.....	.....	.....	.....	.....	2.95	.....	.....	SE	...	...	...	7	...	...
Ames (four miles southwest of)	†79 0	.....	.....	*102	13	*58	29	44	2.47	.....	.....	SW	.....	.....	.....	7	...	...
Amana	75.3	88.4	62.3	96	13	51	27	46	2.70	.....	.....	S	23	8	0	9	...	10
Atlantic	76.1	93.0	59.2	102	14	47	3	55	2.58	.....	.....	S	11	13	7	6	...	3
Audubon	74.9	88.9	61.0	97	14	50	3	47	2.38	.....	.....	S	1	24	6	6	...	...
Belle Plaine	73.8	86.7	60.7	95	13	50	3	45	2.24	.....	.....	S	18	10	3	7	...	7
Blakeville	77.4	.....	.....	96	13	*64	2	32	2.66	.....	.....	SW	18	9	4	5	...	...
Bonaparte	77.0	90.6	63.3	98	23	52	3	46	2.46	.....	.....	.....	...	...	...	5	...	...
Carroll	75.2	87.4	63.0	94	13	50	3	44	4.75	.....	.....	.....	23	3	.5	8	...	...
Cedar Falls	75.0	90.1	60.0	.....	.....	.....	.....	.....	4.47	.....	.....	NW	...	...	...	...	...	...
Cedar Rapids	73.3	86.1	66.6	94	13	58	9	36	1.98	.....	.....	N	27	3	1	7	...	...
Centerville	77.6	89.4	65.9	95	14	58	31	37	2.67	.....	.....	SW	23	8	0	4	...	...
Charles City	73.4	84.6	62.4	91	21	54	3	37	4.72	.....	.....	NW	...	...	...	10	...	...
Clarinda	75.3	84.5	66.1	97	14	58	3	39	6.84	.....	.....	S	17	14	0	9	...	...
Clinton	76.3	89.6	63.0	95	13, 24	53	3, 4	...	2.26	.....	.....	SW	17	12	2	4	1	...
College Springs	74.3	84.9	63.6	97	14	55	3	42	6.13	.....	.....	S	16	10	5	8	...	...
Corning	73.2	84·3	62.1	95	14	52	3	43	4.18	.....	.....	SW	19	10	2	9	...	...
Cresco	71.1	82.0	60.2	93	24	50	27	43	3.85	.....	.....	NW	20	7	4	9	...	7
Davenport	77.0	87.3	66.4	94	23	54	3	40	1.75	.....	.....	SW	15	14	2	4	...	5
Decorah	72.2	84.5	60.6	93	23	51	3	42	6.05	.....	.....	.....	25	4	2	13	...	...
Delaware	73.7	.....	.....	*96	24	...	...	...	3.98	.....	.....	NW	23	8	0	9	...	...
Des Moines (5¼ mi. southwest of)	74.2	85.0	63.4	94	13	53	29	41	2.71	.....	.....	NE	15	14	2	9	...	7
Des Moines	75.4	86.8	64.2	95	14	56	29	39	3.55	.....	.....	SW	16	13	2	10	...	10
Dubuque	76.2	87.0	65.5	96	24	56	27	40	3.57	.....	.....	NW	19	10	2	10	...	...
Eagle Grove	72.7	80.2	65.2	*90	23	*58	29	32	5.35	.....	.....	.....	16	13	2	7	...	...
Denison	†74.9	.....	.....	.....	.....	.....	.....	.....	2.46	.....	.....	.....	...	...	0	5	...	...
Elkader	74.1	88.1	60.5	97	24	50	27	43	2.93	.....	.....	NW	21	9	1	9	...	3
Emmetsburg	72.8	86.6	59.0	97	23	51	9	46	3.56	.....	.....	S	20	2	9	6	...	...
Estherville	72.0	84 6	59.9	.....	.....	.....	.....	.....	.....	.....	.....	.....	...	...	...	...	...	...
Ft. Madison	79.3	.....	.....	*95	24	*65	3	30	2.15	.....	.....	SW	12	14	5	5	...	2
Grand Meadow	72.0	.....	.....	*90	13	*56	29	34	5.72	.....	.....	NW	17	10	4	9	...	...
Greenfield	75.6	87.9	63.3	98	13	52	3	46	2.95	.....	.....	S	17	14	0	6	...	11
Grundy Center	74.3	85.7	62.9	92	14	54	26	38	3.62	.....	.....	NW	21	8	2	9	1	4
Hampton	73.2	83.1	60.2	96	23	50	27	46	4.36	.....	.....	SW	19	8	4	10	...	3
Hopeville	75.3	85.2	65.3	95	14	58	9	37	1.99	.....	.....	SW	8	21	2	5	...	3
Humboldt	.....	.....	.....	.....	.....	.....	.....	.....	4.90	.....	.....	S	21	10	0	9	...	7
Independence	73.9	87.3	60.5	96	24	51	3	45	1.73	.....	.....	W	23	7	1	5	...	...
Iowa City	75.4	87.3	63.2	95	24	55	9	40	3.56	.....	.....	SW	1	24	6	7	...	1
Iowa Falls	72.3	84.3	60.3	92	23	51	4	41	3.24	.....	.....	S	21	3	6	5	...	...
Jefferson	75.4	89.9	60.9	96	14	53	29	43	3.64	.....	.....	S	14	17	0	6	1	...
Keokuk	78.0	82.0	68.0	93	14	61	3	32	2.60	.....	.....	S	18	12	1	9	...	7
Keosauqua	78.2	90.4	66.0	97	13	55	3	42	1.94	.....	.....	.....	...	...	...	5	...	...
Logan	74.8	88.0	61.7	97	12	53	3	44	3.62	.....	.....	S	19	6	6	6	...	...
Knoxville	76.0	88.5	62.5	96	13	52	3	44	2.31	.....	.....	S	17	11	3	6	...	...
Maquoketa	75.0	.....	.....	*95	23	*68	3	27	2.07	.....	.....	.....	...	...	...	5	...	...
Marshalltown	74.0	84.7	63.2	92	15	50	3	42	2.66	.....	.....	S	25	6	0	7	...	...
Mason City	75.1	*7.5	62.8	.....	.....	.....	.....	.....	3.97	.....	.....	.....	...	...	...	...	...	1
Mechanicsville	74.2	86.9	62.9	94	20	56	9	38	2.55	.....	.....	NW	28	3	0	6	...	...
Monticello	74.0	86.0	65.0	*94	15	*50	27	44	1.92	.....	.....	NW	24	7	0	10	...	...
Mooar	†77.2	91.6	62.6	96	26	57	30	59	1.65	.....	.....	.....	27	0	4	5	...	...
Mount Vernon	77.4	.....	.....	.....	.....	.....	.....	.....	2.60	.....	.....	.....	...	...	...	...	...	...
Mount Ayr	76.8	87.7	65.9	93	14	56	31	37	4.75	.....	.....	S	20	7	3	8	...	...
Murray	.....	.....	.....	.....	.....	.....	.....	.....	1.60	.....	.....	.....	24	0	7	7	...	2
Newton	74.6	87.3	62.0	95	13	55	3	40	5.24	.....	.....	S	18	12	1	7	...	...
Omaha (Neb.)	77.5	86.4	68.6	97	12	60	3	37	3.03	.....	.....	SE	15	12	4	7	...	...
Oskaloosa	75.5	87.8	63.3	96	24	52	3	44	1.49	.....	.....	S	25	5	1	5	...	1
Ovid	†76.0	88.4	63.6	72	23	56	3	46	2.40	.....	.....	.....	...	...	...	6	...	...
Panama	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	...	...	...	...	...	...
Richland	76.1	.....	.....	.....	.....	.....	.....	.....	2.21	.....	.....	.....	11	20	0	6	1	4
Rock Rapids	74.8	89.3	60.5	99	22	48	3	51	4.91	.....	.....	S	22	9	0	5	...	...
Sac City	74.5	85.4	63.6	93	12	54	10	39	2.12	.....	.....	SW	19	9	3	4	1	1
Seymour	76.5	89.1	64.0	96	25	55	2	41	2.75	.....	.....	S	26	5	0	5	...	...
Sibley	69.3	84.1	54.4	92	12	47	8	45	3.37	.....	.....	S	23	4	4	2	...	...
Sioux City	75 0	86.6	63.7	97	12	53	1	44	2.29	.....	.....	S	17	10	4	11	...	...
Spirit Lake	75.7	90.4	61.0	99	22	51	5	48	3.41	.....	.....	SW	20	10	1	6	...	3
Storm Lake	74.9	85.7	64.0	95	22	57	29	38	3.99	.....	.....	S	21	9	1	7	1	...
Tipton	75.9	89.2	62.7	97	13	55	26	42	1.69	.....	.....	NW	22	8	1	6	...	5
Villisca	78.1	86.8	69.4	95	15	60	3	35	5.72	.....	.....	SW	...	...	...	8	...	...
Vinton	74.5	.....	.....	*94	24	*59	29	35	1.65	.....	.....	NW	25	5	1	5	...	2
Washington	81.5	.....	.....	*100	14	*56	3	44	.....	.....	.....	SW	...	...	...	4	...	...
Webster City	75.3	.....	.....	*96	14	*60	29	36	3.90	.....	.....	SE	16	15	0	5	...	10
West Bend	†69.6	.....	.....	*91	13	*52	5	39	2.40	.....	.....	.....	...	...	...	5	...	...
Williams	72.6	.....	.....	*93	24	*57	29	36	5.93	.....	.....	S	19	12	0	12	...	...
Winterset	76.5	89.1	63.8	98	13	54	9	44	2.00	.....	.....	SW	16	6	9	6	...	...
Means	75.0	83.7	62.9	95.2	.....	54.4	.....	40.8	3.33	.....	.....	.....	18.7	9.8	2.4	7.0	1	4.9

*Taken from observed readings; all others eye readings.
†Not included in means.

DAILY AND MONTHLY MEAN TEMPERATURE FOR JULY, 1893.

STATIONS.	DATE.																															Monthly Mean.
	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	31st.	
Algona	70	71	75	72	74	74	76	65	71	74	78	82	78	77	72	71	68	67	70	72	74	78	79	79	76	71	70	68	71	74	70	73.2
Alta	70	69	70	72	72	74	76	69	72	74	76	79	76	74	74	75	68	69	71	73	72	74	78	79	71	66	72	72	75	70	76	67	72.0
Ames (W. R. Cooper)	70	70	68	74	76	76	78	72	68	70	74	79	84	82	76	70	71	72	71	60	72	75	78	78	79	72	64	78	69	71	70	73.2
Ames (4 mi. S. W. of)	77	78	77	80	78	83	80	78	78	78	82	82	85	84	86	81	76	80	78	78	80	80	82	80	80	80	78	73	77	73	76	74	79.1
Amana	74	72	70	78	78	78	81	74	70	75	78	81	86	82	80	76	72	72	70	72	74	76	78	80	81	72	68	78	72	74	74	75.3
Atlantic	74	70	70	77	74	81	81	73	71	73	78	82	88	87	81	76	74	76	74	76	74	76	78	82	84	69	69	78	70	74	68	76.1
Audubon	72	71	69	75	76	78	66	79	71	72	76	82	86	85	80	75	73	72	70	74	74	88	77	77	82	71	68	76	74	72	71	74.9
Belle Plaine	70	72	68	74	74	77	79	71	69	73	75	81	85	80	78	74	71	70	69	72	72	73	76	79	80	70	69	74	70	74	73	73.8
Blakeville	74	72	75	75	78	78	79	78	78	80	82	82	83	80	82	79	76	77	76	78	78	80	82	81	78	76	72	72	75	75	70	77.4
Bonaparte	76	75	71	72	78	80	81	76	72	75	76	80	84	84	78	76	74	75	75	78	78	80	80	80	76	70	80	74	79	76	77.0
Carroll	71	74	67	75	75	80	74	76	77	79	80	81	84	82	78	71	73	74	78	74	78	76	76	76	78	71	66	68	73	75	70	75.2
Cedar Rapids	74	75	72	76	74	78	82	77	70	76	77	82	85	82	80	78	74	72	72	72	73	76	80	81	82	74	70	76	72	74	74	76.3
Cedar Falls	...	...	...	...	...	...	...	...	...	...	...	...	78	76	80	75	78	72	72	72	74	76	79	81	80	69	65	76	76	74	73	75.0
Centerville	75	76	74	74	77	82	82	79	74	74	76	82	82	85	78	75	75	74	76	76	79	83	82	80	80	75	81	79	74	70	77.6
Charles City	70	72	69	71	71	75	78	70	70	74	76	80	82	80	76	71	68	72	70	72	71	76	77	80	79	76	65	78	70	72	70	73.4
Clarinda	72	70	72	74	74	82	81	76	73	74	74	80	83	84	78	74	76	70	72	73	73	76	79	80	78	72	70	76	70	74	70	75.5
Clinton	76	74	70	70	76	77	82	75	72	74	76	81	80	81	84	80	76	74	72	75	74	76	80	79	80	76	70	78	74	76	76	76.3
College Springs	74	72	71	75	72	78	80	75	76	75	76	80	83	85	76	72	74	67	72	72	73	77	78	78	70	71	71	70	68	71	68	74.3
Corning	70	70	68	74	72	82	79	74	68	71	74	79	82	81	76	72	73	70	70	71	70	73	74	78	78	69	70	76	67	72	69	73.2
Cresco	68	70	66	69	67	70	74	68	67	70	74	76	78	76	74	72	66	68	68	70	71	73	78	80	78	67	66	72	68	72	69	71.1
Davenport	77	75	72	72	78	76	83	76	72	76	75	82	83	84	80	79	74	72	76	77	78	81	82	80	76	70	77	74	77	76	77	77.0
Decorah	70	75	67	72	72	76	75	68	71	71	74	79	80	79	74	72	68	66	69	72	76	78	80	74	64	72	68	70	72	72	65	72.2
Delaware	72	70	73	72	72	76	80	69	70	72	74	78	81	74	78	75	68	70	68	72	73	75	78	80	82	69	72	71	72	74	71	73.6
Denison	71	...	75	70	...	76	...	...	77	...	...	82	...	78	72	74	...	68	74	77	74	76	...	78	76	79	72	...	...	...	...	74.9
Des Moines (5½ miles southwest of)	72	72	72	75	74	76	78	73	68	72	76	80	84	82	78	72	72	70	72	74	72	74	78	80	80	70	66	78	68	72	70	74.2
Des Moines	73	74	72	75	74	76	80	74	71	74	76	81	84	84	79	74	73	72	74	72	74	76	80	81	81	72	69	78	69	70	72	72	75.4
Dubuque	76	73	72	76	74	74	84	74	71	73	76	82	84	84	79	78	72	71	72	74	76	78	82	82	83	74	70	75	74	77	76	76.2
Eagle Grove	70	72	69	74	72	76	78	68	71	72	73	79	77	80	76	73	68	69	70	71	72	76	79	79	77	70	65	72	68	72	68	72.7
Elkader	72	72	70	72	72	73	81	73	64	74	77	82	82	81	80	76	71	70	70	72	73	76	79	80	80	70	62	75	70	74	74	74.1
Emmetsburg	68	72	71	73	72	69	74	68	68	74	77	79	78	78	74	72	68	68	72	74	74	78	81	80	78	70	67	73	70	73	67	72.8
Estherville	...	...	...	...	...	...	...	...	...	...	...	...	78	78	71	70	68	62	67	78	...	...	...	80	76	68	66	72	72	76	70	72.0
Ft. Madison	77	78	74	71	77	83	84	78	75	78	80	83	84	92	82	82	76	78	74	78	77	81	85	82	84	78	75	82	81	75	76	79.3
Grand Meadow	70	68	71	70	70	80	74	68	69	70	76	78	79	74	74	71	68	67	73	70	72	76	76	80	77	68	67	68	70	72	68	72.0
Greenfield	74	72	70	75	74	80	80	72	76	97	78	79	86	82	76	72	72	72	74	74	76	78	80	80	82	71	70	76	72	74	68	75.6
Grundy Center	74	70	74	73	76	79	76	68	72	76	78	80	82	81	75	74	69	71	71	73	75	77	78	81	74	68	74	72	72	72	68	74.3
Hampton	70	72	72	72	70	76	74	68	68	74	76	78	78	78	76	72	68	70	71	71	74	76	81	80	79	69	66	71	70	72	70	73.2
Hopeville	73	72	72	74	74	81	80	74	70	74	76	80	83	82	76	74	74	72	73	73	74	78	78	80	79	72	71	80	71	75	70	75.3
Independence	70	70	69	73	72	...	...	...	70	74	75	81	80	80	78	74	70	70	70	72	74	75	78	80	80	70	70	68	74	70	74	73	73.9
Iowa City	74	72	75	73	76	76	77	76	70	72	76	80	82	80	77	76	75	78	71	76	74	76	78	79	80	73	68	74	72	76	77	75.4
Iowa Falls	70	70	73	66	72	72	77	68	68	72	...	78	82	82	79	77	68	68	70	72	72	75	78	78	78	68	65	68	64	72	70	72.3
Jefferson	72	72	71	75	74	76	80	76	66	75	79	82	84	82	80	74	74	72	73	70	74	76	80	78	81	76	72	75	68	77	74	75.4
Keokuk	78	78	74	78	74	83	84	78	74	76	78	81	84	84	78	78	74	76	75	77	80	79	82	83	82	79	71	78	78	78	76	78.0
Keosauqua	78	76	74	76	77	84	84	77	74	78	79	82	84	84	80	78	76	74	76	75	78	78	82	82	82	78	70	81	76	78	76	78.2
Knoxville	75	74	74	75	75	78	80	75	72	74	76	80	86	82	79	75	74	73	72	73	74	78	80	80	81	75	69	78	72	73	72	76.0
La Crosse (Wis.)	74	72	70	74	77	68	76	76	72	70	78	80	83	80	78	76	70	70	73	73	74	78	78	84	82	71	68	72	72	73	74	74.0
Logan	73	70	70	74	74	76	82	64	73	73	76	86	84	84	80	74	72	73	73	75	72	74	77	78	76	76	70	75	68	78	72	74.8
Maquoketa	71	72	70	72	76	78	82	74	76	75	80	80	81	86	78	79	72	71	72	73	72	74	76	76	74	72	71	71	73	74	75	75.0
Marshalltown	72	66	66	74	76	75	78	76	67	73	77	76	79	81	80	75	74	70	70	70	72	74	77	82	80	74	66	75	71	74	70	74.0
Mason City	...	...	...	88	92	81	70	72	74	73	74	77	80	82	72	70	72	71	70	70	74	74	78	80	77	66	74	74	73	75	72	75.1
Mechanicsville	73	73	72	72	73	76	78	74	69	74	73	78	82	79	80	77	75	72	70	76	78	78	78	78	79	72	69	74	72	74	74	74.9
Monticello	68	70	71	72	75	79	80	71	72	74	76	78	80	80	78	76	70	70	71	73	74	77	78	79	81	70	66	72	71	76	68	74.0
Mooar	74	74	76	77	78	79	82	80	80	80	80	80	80	78	76	72	74	74	70	80	81	80	79	78	78	79	78	76	74	76	75	77.2
Mt. Vernon	74	76	74	75	75	81	83	76	75	78	79	82	82	80	81	78	74	74	76	76	80	78	82	88	84	73	72	74	75	79	74	77.4
Mt. Ayr	75	76	75	76	74	72	81	76	74	74	75	78	82	80	77	76	79	72	...	...	...	...	...	...	...	...	...	76	80	72	76	...	76.8
Newton	73	73	71	74	74	76	78	76	70	73	76	79	84	82	78	73	72	71	72	72	72	76	78	80	80	73	68	76	70	74	72	74.6
Omaha (Neb.)	74	70	73	74	76	80	83	72	74	77	78	85	86	80	76	74	72	73	76	76	80	80	82	83	74	72	76	71	76	72	77	77.5
Oskaloosa	72	73	66	73	75	76	82	74	70	73	78	80	85	83	77	74	74	72	71	77	74	75	78	82	82	74	68	78	72	75	74	75.5
Ovid	74	73	72	74	75	78	79	76	72	74	76	80	84	83	78	76	76	73	74	74	76	76	79	79	74	70	80	73	76	74	76	76.0
Richland	73	73	75	70	78	78	80	72	74	79	80	80	81	83	76	78	70	72	72	76	78	78	80	80	82	72	71	75	77	75	73	76.1
Rock Rapids	67	72	66	75	75	72	69	65	75	76	78	91	78	79	74	76	72	72	72	73	73	80	86	84	79	72	77	68	74	72	75	74.8
Sac City	71	74	74	74	73	78	72	74	72	78	76	80	78	77	73	72	70	72	76	77	76	79	82	82	78	73	64	73	70	78	68	74.5
Seymour	73	70	76	73	77	82	80	76	73	75	76	80	53	83	78	75	71	72	73	74	75	78	81	80	82	76	70	79	81	77	72	76.5
Sibley	64	67	65	66	69	68	72	63	68	70	70	72	76	79	69	70	62	68	68	68	69	72	74	78	75	68	65	72	66	70	63	69.3
Sioux City	68	70	72	73	76	76	78	69	74	77	78	85	82	82	75	73	70	73	70	76	76	80	82	85	80	74	68	73	70	78	70	75.0
Spirit Lake	77	72	71	74	68	74	78	70	70	78	78	81	80	78	78	75	71	73	73	78	76	82	80	80	78	79	72	72	72	78	68	75.7
Storm Lake	70	71	74	76	74	73	76	68	73	74	78	82	80	78	77	74	70	70	74	74	78	81	82	82	80	72	68	75	72	78	69	74.9
Tipton	74	72	76	74	78	80	80	70	75	76	80	83	83	84	78	77	72	70	72	74	74	72	82	80	78	70	72	74	74	78	70	75.9
Villisca	74	80	72	73	80	74	82	78	76	76	77	78	82	85	86	78	84	76	76	77	76	76	82	82	82	78	72	77	77	75	78	78.1
Vinton	71	71	73	68	74	78	81	70	71	74	77	80	78	80	80	76	71	70	72	71	75	78	79	82	79	71	69	72	71	75	72	74.5
Washington	82	80	81	78	80	84	83	76	80	81	84	86	86	90	84	84	78	76	77	78	84	84	84	86	88	79	79	82	78	80	77	81.5
Webster City	73	73	76	71	74	76	78	73	74	76	78	78	80	76	79	75	74	74	73	72	76	78	79	80	78	71	71	76	74	75	74	75.3
West Bend	63	64	68	63	53	60	70	72	64	70	75	78	78	73	70	70	74	75	76	76	66	66	68	71	70	70	68	74	74	65	...	69 6
Williams	71	68	73	69	74	78	76	67	70	73	76	78	77	79	71	72	68	72	73	72	74	75	77	79	76	70	70	68	68	70	73	66	76.2
Winterset	75	74	73	76	75	80	80	74	70	74	78	80	86	84	78	74	74	72	74	72	82	77	80	82	81	72	70	78	73	74	72	76.5

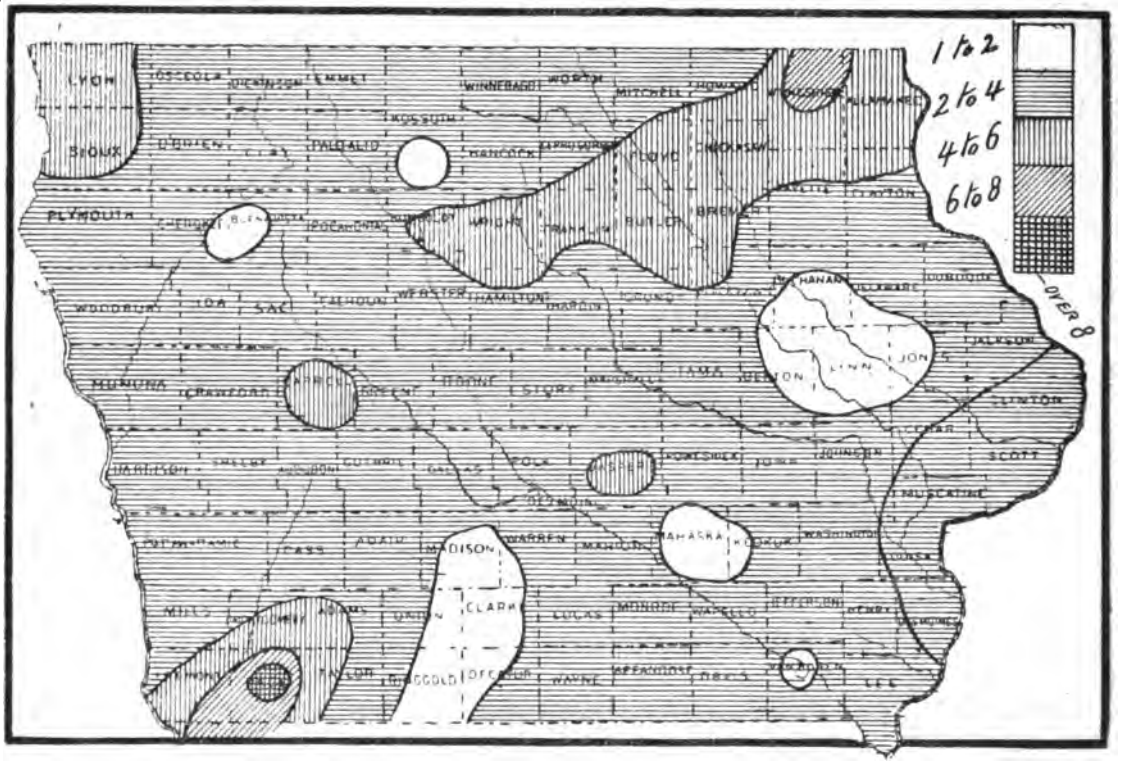
DAILY AND MONTHLY PRECIPITATION FOR JULY, 1893.

STATIONS.	DATE.																																					Total.
	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th	27th.	28th.	29th.	30th.	31st.							
Algona	....	....	0.44	....	0.15	0.42	0.20	....	....	....	....	....	....	0.03	0.06	....	....	....	....	....	....	....	....	....	....	....	....	0.57	....	....	....	....	....	....	....	....	....	....	1.87
Alta	....	....	....	0.46	1.21	1.49	0.31	....	....	....	T	..	0.04	0.12	0.41	....	....	....	....	....	....	....	....	....	0.02	....	0.19	0.31	....	0.05	....	....	....	....	....	....	....	....	4.61
Ames (W. R. Cooper)	....	....	....	0.11	....	0.47	0.02	0.43	....	....	....	....	0.64	....	0.03	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.01	..	....	....	....	....	....	....	....	1.62
Ames (E. N. Eaton)	....	....	....	0.43	0.47	....	0.28	....	....	....	....	....	0.65	....	0.75	....	....	....	....	....	....	....	....	....	....	....	....	0.36	....	0.01	....	....	....	....	....	....	....	....	2.95
Ames, four miles southwest of	....	....	....	.33	.37	....	0.15	....	....	....	....	....	.72	.01	.66	....	....	....	....	....	....	....	....	....	....	....	.01	.22	....	....	....	....	....	....	....	....	....	....	2.47
Amana	0.04	....	....	0.10	....	0.85	....	0.45	....	....	....	....	0.08	0.21	0.12	0.05	....	....	....	....	....	....	....	....	....	....	....	0.80	....	....	....	....	....	....	....	....	....	....	2.70
Atlantic	....	....	....	0.91	....	....	T	....	....	....	....	....	....	....	0.53	....	....	....	....	....	....	....	....	....	T	....	0.33	0.56	....	0.25	....	....	....	....	....	....	....	....	2.58
Audubon	T	....	....	0.01	....	0.41	....	....	....	....	....	....	T	....	0.17	....	....	....	....	....	....	....	....	....	0.20	....	0.80	....	....	0.19	....	....	....	....	....	....	....	....	2.38
Belle Plaine	....	....	....	0.23	0.72	....	T	0.26	....	....	....	....	0.38	0.20	0.26	....	....	....	....	....	....	....	....	....	T	....	T	0.20	....	....	....	....	....	....	....	....	....	....	2.24
Blakeville	....	....	....	0.04	1.96	....	....	T	....	....	T	0.06	....	0.22	....	....	....	....	....	....	....	....	....	....	....	....	T	....	0.38	....	....	....	....	....	....	....	....	....	2.66
Bonaparte	....	....	....	0.47	....	....	0.61	....	....	....	....	....	....	1.03	0.19	....	0.16	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2 46
Carroll	....	....	....	0.78	0.98	0.12	....	....	....	....	T	T	0.32	....	0.92	....	....	....	....	....	....	....	....	0.23	....	....	0.47	....	....	1.03	....	....	....	....	....	....	....	....	4.75
Cedar Falls	....	....	....	....	....	....	....	....	....	....	....	....	0.15	0.32	....	0.65	....	....	....	....	....	....	....	....	....	....	....	....	0.20	....	....	....	....	....	....	....	....	....	4.47
Cedar Rapids	0.01	....	....	0.05	....	0.82	....	0.30	....	....	....	....	0.15	0.04	0.02	T	....	....	....	....	....	....	....	....	....	....	....	0.59	....	....	....	....	....	....	....	....	....	....	1.98
Centerville	....	....	....	....	....	....	....	0.70	....	....	....	....	....	1.10	0.55	....	....	....	....	....	....	....	....	....	....	....	....	0.32	....	....	....	....	....	....	....	....	....	....	2.67
Charles City	....	....	....	0.48	1.07	1.37	0.94	....	....	....	....	0.11	0.02	0.31	0.12	....	....	....	....	....	....	....	....	....	....	....	0.05	0.25	....	....	....	....	....	....	....	....	....	....	4.72
Clarinda	T	....	....	1.20	....	....	....	....	....	....	....	....	....	3.05	0.44	....	1.35	1.70	....	....	....	....	....	....	0.07	T	0 24	0.41	....	0.38	....	....	....	....	....	....	....	....	8.84
Clinton	....	....	....	.03	.48	....	....	.25	....	....	....	....	1.50	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
College Springs	....	....	....	0.94	....	....	....	....	....	....	....	....	2.19	0.76	....	....	....	0.53	....	....	....	....	....	....	0.58	T	0.41	0.53	....	0.19	....	....	....	....	....	....	....	....	6.13
Corning	....	....	....	1.03	....	....	T	....	....	....	T	....	....	0.65	0.07	0.48	0 60	0.34	....	....	....	....	....	....	....	....	0 23	0.72	....	0.06	....	....	....	....	....	....	....	....	4.18
Oresco	....	....	....	0.12	0.95	1.05	0.71	....	0.07	....	....	0.09	....	0.72	0.04	....	....	....	....	....	....	....	....	....	....	....	0.10	....	....	....	....	....	....	....	....	....	....	....	3.86
Davenport	....	....	....	0.07	T	1.28	....	0.26	....	....	....	T	....	....	T	....	....	....	....	....	....	....	....	....	....	....	T	0.14	....	....	....	....	....	....	....	....	....	....	1.75
Decorah	0.10	0.01	....	0.04	0.82	0.98	1.30	....	0.19	....	....	0.26	1.95	0.10	0.02	....	....	....	....	....	....	....	....	0.12	....	0.16	....	....	....	....	....	....	....	....	....	....	....	....	6.05
Delaware	....	....	....	0.06	0.30	0.60	....	0.51	....	....	....	....	0.26	1.21	0.42	....	....	....	....	....	....	....	....	....	....	....	0.02	0.60	....	....	....	....	....	....	....	....	....	....	3.98
Denison	....	....	.71	....	....	....	16	....	....	....	T	....	0.32	....	0.43	....	....	....	....	....	....	....	....	....	....	....	0.84	....	....	....	....	....	....	....	....	....	....	....	2.46
Des Moines	....	....	....	0.78	T	1 15	T	0.21	....	....	....	0.09	0.02	0.04	0.64	....	....	....	....	....	....	....	....	....	0.01	....	T	0.58	....	T	....	....	....	....	....	....	....	....	3.55
Des Moines (5¼ mi. southeast of)	....	....	....	0.65	0.80	..	0.05	0.18	....	....	....	T	....	0.15	....	0.40	....	....	....	....	....	....	....	....	0.26	....	0.05	0.17	....	....	....	....	....	....	....	....	....	....	2.71
Dubuque	....	0.14	....	0.01	....	0.63	....	0.70	....	0.19	....	....	....	0.04	0.95	0.02	....	....	....	....	....	....	....	....	....	T	0.01	0.88	....	....	....	....	....	....	....	....	....	....	3.57
Eagle Grove	....	....	....	0.75	1.25	1.10	0 50	....	....	....	....	0.25	0.40	....	1.10	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5.35
Elkader	....	....	....	0.01	....	1.48	0.38	....	0.05	....	....	....	0.02	0.37	....	0.14	....	....	....	....	....	....	....	....	0.24	....	....	0.24	....	....	....	....	....	....	....	....	....	....	2.93
Emmetsburg	....	....	....	0.59	....	0.26	1.52	....	....	....	....	....	....	0.30	0.16	....	....	....	....	....	....	....	....	....	....	....	....	0.73	....	....	....	....	....	....	....	....	....	....	3.56
Estherville	....	....	....	....	....	....	....	....	....	....	....	....	....	0.15	....	T	T	....	....	....	....	....	....	....	....	T	....	0.56	0.12	....	....	....	....	....	....	....	....	....	0.83
Ft. Madison	....	....	....	0.77	....	....	....	0.25	....	....	....	....	....	....	0.57	....	T	....	....	....	....	....	....	....	0.40	....	....	0.16	....	T	....	....	....	....	....	....	....	....	2.15
Grand Meadow	....	....	0.04	....	1.76	....	0.61	....	T	0.10	....	T	T	0.75	1.22	0.04	....	....	....	....	....	....	....	....	0.75	....	....	0.45	....	....	....	....	....	....	....	....	....	....	5.72
Greenfield	T	....	....	0.89	T	T	T	....	....	....	T	....	T	1.05	....	0.26	....	....	....	....	....	....	....	....	T	....	0.22	0.47	....	0.06	....	....	....	....	....	....	....	....	2.95
Grundy Center	....	....	0.15	....	1.10	....	0.16	....	....	....	T	T	0.18	0.12	0.24	....	....	....	....	....	....	....	....	....	....	....	0.27	....	....	....	....	....	....	....	....	....	....	....	3.62
Hampton	....	....	....	0.17	1.52	0.69	0.91	....	....	....	....	0.20	0.04	0.15	0.36	....	....	....	....	....	....	....	....	....	T	....	0.06	0.28	....	....	....	....	....	....	....	....	....	....	4.36
Hopeville	....	....	....	0.50	T	T	....	....	....	....	T	....	....	0.42	....	0.66	....	....	....	....	....	....	....	....	T	....	0.09	0.32	....	T	....	....	....	....	....	....	....	....	1.99
Humboldt	....	....	....	0.28	....	1.07	1.41	....	....	....	....	0 11	0.05	0.02	1.57	....	....	....	....	....	....	....	....	....	....	....	0.07	0.32	....	....	....	....	....	....	....	....	....	....	4.90
Independence	....	....	....	T	....	0.50	T	....	....	....	....	....	....	0.75	0.08	....	....	....	....	....	....	....	....	....	0.10	....	....	0.30	....	....	....	....	....	....	....	....	....	....	1.73
Iowa City	....	....	....	0.10	....	1.63	....	0.15	....	....	....	0.01	1.19	0.28	....	....	....	....	....	....	....	....	....	....	T	....	....	0.20	....	....	....	....	....	....	....	....	....	....	3.56
Iowa Falls	....	....	....	....	1.93	....	0.52	....	....	....	....	0.13	....	....	0.38	....	....	....	....	....	....	....	....	....	....	....	....	0.28	....	....	....	....	....	....	....	....	....	....	3.24
Jefferson	....	....	....	0.51	....	0.90	....	0.04	....	....	....	T	....	1.01	....	0.43	....	....	....	....	....	....	....	....	....	....	....	0.75	....	....	....	....	....	....	....	....	....	T	3.64
Keokuk	0.12	....	....	0.44	....	T	....	1.24	....	....	....	....	....	....	0.08	0.12	0.37	....	....	....	....	....	....	....	0.20	....	T	0 02	....	0.01	....	....	....	....	....	....	....	....	2.60
Keosauqua	....	....	....	0.18	....	....	....	0.54	....	....	....	....	....	....	1.04	0.11	0.07	....	....	....	....	....	....	....	T	....	T	T	....	T	....	....	....	....	....	....	....	....	1.94
Knoxville	....	....	....	86	....	11	....	21	....	....	....	....	....	....	39	27	..	....	....	....	....	....	....	....	....	....	....	47	T	....	....	....	....	....	....	....	....	....	2.31
La Crosse (Wis)	T	0.01	....	0.01	....	1.12	0.89	0 04	0.08	....	....	0.15	0.01	0.30	T	....	....	....	....	....	....	....	....	....	T	....	....	0.63	....	T	....	....	....	....	....	....	....	....	3.19
Logan	0.55	....	....	0.97	....	....	....	....	....	....	....	....	0.07	....	0.60	....	....	....	....	....	....	....	....	....	....	....	0.40	1.03	....	....	....	....	....	....	....	....	....	....	3.62
Maquoketa	....	....	....	....	....	0.90	....	0 55	....	....	....	....	0.12	....	....	....	....	....	....	....	....	....	....	....	T	....	0.05	0.45	....	....	....	....	....	....	....	....	....	....	2.07
Marshalltown	....	....	....	0.29	....	0.40	0.13	....	....	....	....	0.10	0.19	....	1.20	....	....	....	....	....	....	....	....	....	....	....	T	0.35	....	....	....	....	....	....	....	....	....	....	2.66
Mason City	....	....	....	1.40	1.00	....	....	....	....	....	....	0.50	....	1.02	....	....	....	....	....	....	....	....	....	....	....	....	0.10	0.13	....	....	....	....	....	....	....	....	....	....	3.97
Mechanicsville	....	....	....	0.23	....	1.06	....	0.30	....	....	....	T	0.28	0.13	....	....	....	....	....	....	....	....	....	....	....	....	....	0.55	....	....	....	....	....	....	....	....	....	....	2.55
Monticello	....	0.01	....	0.10	....	0.70	....	0.27	....	....	....	....	0.04	0.01	....	0.20	....	....	....	....	....	....	....	....	....	....	....	0.59	....	....	....	....	....	....	....	....	....	....	1.92
Mooar	....	....	....	.40	....	....	.58	....	....	....	....	....	....	.08	....	.44	....	....	....	....	....	....	....	....	....	....	....	.15	....	....	....	....	....	....	....	....	....	....	1.65
Mt. Ayr	....	....	....	1.22	....	T	....	T	....	....	....	....	....	1.98	....	0.53	T	0.04	....	....	....	....	....	....	0.25	....	0.19	0.47	....	0.07	....	....	....	....	....	....	....	....	4.75
Murray	....	....	....	0.65	....	....	....	0.06	....	T	....	....	....	0.22	0.31	....	....	....	....	....	....	....	....	....	....	....	0.02	0.52	....	0.02	....	....	....	....	....	....	....	....	1.60
Newton	....	....	....	0.84	T	2.78	....	....	....	....	T	T	0.02	....	0.42	0.70	....	....	....	....	....	....	....	....	0.07	....	T	0.41	....	....	....	....	....	....	....	....	....	....	5.24
Omaha (Neb.)	0.59	T	....	1.39	T	T	T	....	....	....	T	....	T	.01	T	.17	....	.14	....	....	....	....	....	....	....	....	.32	.41	T	T	....	....	....	....	....	....	....	....	3.03
Oskaloosa	....	....	....	0.54	T	....	0.25	....	....	....	....	T	T	0.25	0.22	....	....	....	....	....	....	....	....	....	T	....	....	0.23	....	T	....	....	....	....	....	....	....	....	1.49
Ovid	....	....	....	.42	....	....	....	17	....	....	....	....	T	.44	....	1.21	....	....	....	....	....	....	....	....	....	....	.02	.14	....	T	....	....	....	....	....	....	....	....	2.40
Richland	....	....	....	0.52	0.12	....	....	1.27	....	....	....	....	....	....	0.24	0.01	....	....	....	....	....	....	....	....	T	....	T	0.05	....	....	....	....	....	....	....	....	....	....	2.21
Rock Rapids	....	....	1.54	....	0.64	0.70	....	....	....	....	....	....	....	0.22	....	....	....	....	....	....	....	....	....	....	T	....	1.81	....	....	....	....	....	....	....	....	....	....	....	4.01
Sac City	....	....	....	....	....	1.50	....	....	....	....	....	....	0.10	....	....	....	....	....	....	....	....	....	....	....	0.02	....	0.50	....	....	....	....	....	....	....	....	....	....	....	2.12
Seymour	....	....	....	0.07	....	....	....	0.85	T	....	....	....	....	0.55	....	1.15	....	....	....	....	....	....	....	....	....	....	....	0.13	....	....	....	....	....	....	....	....	....	....	2.75
Sibley	....	....	....	1.35	....	....	....	....	....	....	....	....	T	T	T	....	....	....	....	....	....	....	....	....	....	....	2.02	....	....	....	....	....	....	....	....	....	....	....	3.37
Sioux City	0.02	T	....	0.89	0.02	0.01	0.26	....	....	....	T	....	0.02	0.03	0.21	....	T	T	....	....	....	....	....	....	0.02	....	0.53	0.28	....	....	....	....	....	....	....	....	....	....	2.29
Spirit Lake	....	....	....	0.68	....	0.05	0.03	....	....	....	....	....	0.04	....	....	....	....	....	....	....	....	....	....	....	....	....	2.01	0.60	....	....	....	....	....	....	....	....	....	....	3.41
Storm Lake	....	....	....	....	0.22	1.36	2.07	....	....	....	T	T	0.06	0.04	....	....	....	....	....	....	....	....	....	....	T	....	0.12	0.16	....	T	....	....	....	....	....	....	....	....	3.99
Tipton	....	....	....	0.18	....	0.76	0.31	....	....	....	....	....	0.13	0.14	....	....	....	....	....	....	....	....	....	....	....	....	....	0.17	....	....	....	....	....	....	....	....	....	....	1.69
Villisca	....	0.54	....	1.48	....	....	....	....	....	....	....	....	....	....	1.12	.28	....	1.44	....	....	....	....	....	....	....	....	.15	1.01	....	....	.20	....	....	....	....	....	....	....	5.72
Vinton	....	....	....	0.16	....	0.81	....	....	....	....	....	....	0.05	....	0.16	....	....	....	....	....	....	....	....	....	....	....	....	0.47	....	....	....	....	....	....	....	....	....	....	1.65
Washington	....	....	....	0.32	....	0.28	....	1.55	....	....	....	....	....	0.12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2.27
Webster City	....	....	....	0.88	T	2.38	T	....	....	T	T	T	T	....	0.38	....	....	....	....	....	....	....	....	....	0.38	....	....	0.38	....	T	....	....	....	....	....	....	....	....	3.90
West Bend	....	T	.84	.01	....	....	....	....	....	07	....	....	....	.84	....	....	....	....	....	....	.64	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2.40
Williams	....	....	....	0.31	3.16	0.08	0.74	....	....	....	....	0.11	0.04	0.02	0.46	....	....	....	....	....	....	....	....	....	0.14	....	0.07	0.77	....	0.09	....	....	....	....	....	....	....	....	5.93
Wintersct	....	....	....	0.02	....	....	T	....	....	....	T	....	....	0.64	0.22	....	....	....	....	....	....	....	....	....	0.01	....	0.10	0 11	....	T	....	....	....	....	....	....	....	....	2.00

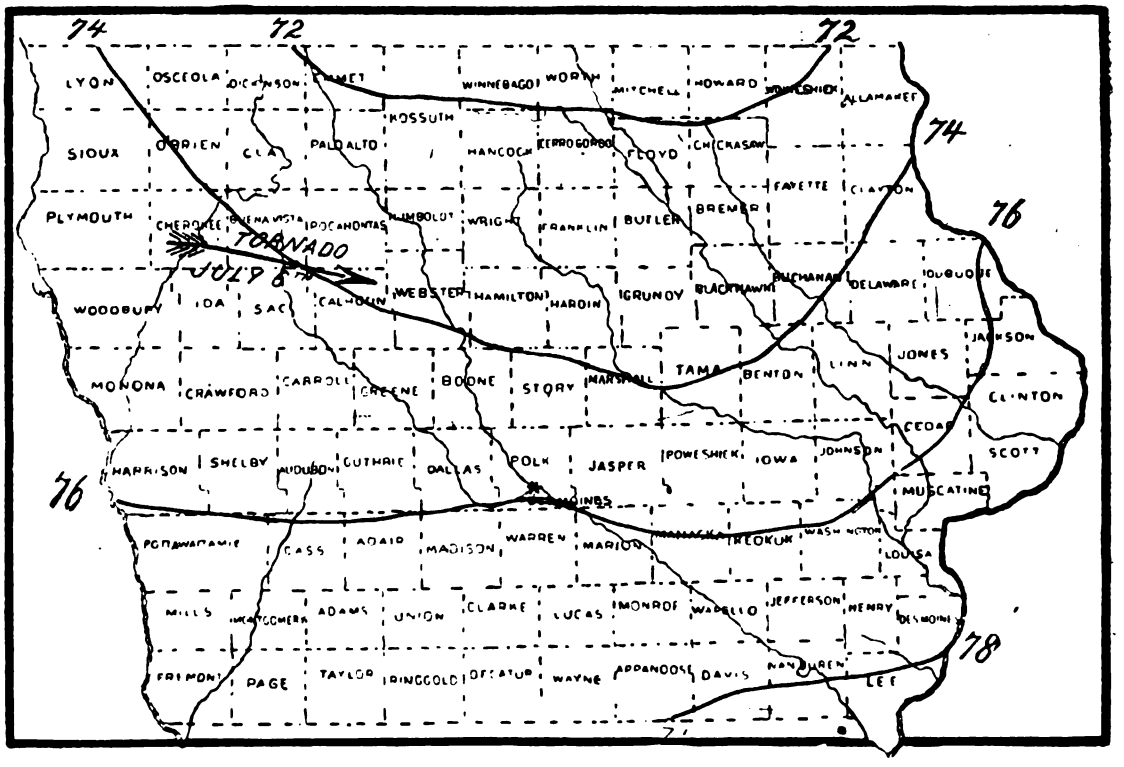
MAXIMUM AND MINIMUM TEMPERATURE FOR JULY, 1893.

| STATIONS. | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | | 9 | | 10 | | 11 | | 12 | | 13 | | 14 | | 15 | | 16 | | 17 | | 18 | | 19 | | 20 | | 21 | | 22 | | 23 | | 24 | | 25 | | 26 | | 27 | | 28 | | 29 | | 30 | | 31 | | Monthly Mean. | |
|---|---|---

IOWA PRECIPITATION CHART. JULY 1893.



MEAN TEMPERATURE JULY 1893



METEOROLOGICAL STATIONS AND OBSERVERS.

From the following, weekly and monthly reports of Meteorological data are received by the Iowa Weather and Crop Service.

Albia	Gus Johnson.
Algona	C. D. Pettibone.
Alta	D. E. Hadden.
Amana	Conrad Schadt.
Ames	E. C. Dickinson.
Ames	W. H. Heileman.
Ames, (4 miles S. W.)	Isaac Young
Atlantic	J. W. Love.
Audubon	J. F. Hocker.
Belle Plaine	H. W. Vandike.
Blakeville	James Rodgers.
Blockton	C. W. Thompson.
Bonaparte	Hon. B. R. Vale.
Carroll	Moses Simon.
Cedar Falls	Prof. A. C. Page.
Cedar Rapids	H. D. Olds.
Centerville	Prof. R. E. Reister.
Charles City	J. W. Smith.
Clarinda	A. S. Van Sandt.
Clinton	Luke Roberts.
College Springs	A. A. Berry.
Concord	J. M. Elder.
Corning	John W. Bixby.
Cresco	Gregory Marshall.
Council Bluffs	E. W. Hart.
Davenport	*F. J. Walz.
Delaware	Wm. Ball.
Decorah	L. H. Baker.
Denison	P. H. Schlumberger.
Des Moines	*Geo. M. Chappel, M. D.
Dubuque	*S. C. Emery.
Eagle Grove	C. A. Schaffter.
Eldora	Prof. C. F. Woodward.
Elkader	Chas. Reinecke.
Emmetsburg	H. Conroy.
Estherville	Leroy L. Barnham.
Fairfield	J. Fred Clarke, M. D.
Fayette	R. Z. Latimer.
Ft. Madison	Miss L. A. McCready.
Galva	W. A. Crowley.
Glenwood	Seth Dean.
Greenfield	J. G. Culver.
Grinnell	Prof. S. J. Buck.
Grundy Center	Chas. G. Rogers.
Hampton	E. C. Grenelle.
Hawkeye	J. W. Bopp.
Hopeville	M. T. Ashley.
Hopkinton	Theo. Marks
Humboldt	J. W. Foster.
Independence	E. F. Wulfke.
Indianola	Prof. J. L. Tilton.
Iowa City	Prof. A. L. Arner.
Iowa Falls	J. B. Parmelee.
Jefferson	Dr. Chas. Enfield.
Keokuk	*Fred. Z. Gosewisch.
Keosauqua	Prof. J. H. Landes.
Larrabee	H. B. Strever.
Logan	Mrs. M. B. Stern.
Mason City	H. I. Smith.
Manson	W. L. Thompson.
Marshalltown	L. S. Kilborn.
Maquoketa	Dr. A. B. Bowen.
Mechanicsville	Rev. J. W. Hubbard.
Milton	Hon E. C. Holland.
Mooar	F. G. Thomas
Monticello	Henry D. Smith
Mount Vernon	Prof. A. Collin.
Mt. Ayr.	Hon. Wm. Shriver.
Murray	A. W. Lewis.
Muscatine	J. P. Walton.
Newton	A. Lufkin
Omaha, Neb.	*Geo E. Hunt.
Ovid	H. C. Miller.
Osage	G. D. Pattingill
Oskaloosa	Jos. Boyd.
Panama	Wm. J. Wicks.
Postville	F. L. Williams.
Richland	Wm. A. Shaffer.
Rock Rapids	W. C. Wyckoff.
Seymour	Mrs. C. A. Conger.
Sibley	H. G. Doolittle.
Sidney	G V. Swearingen.
Sioux City	*U. G. Purse
Sac City	Dr. C. Brow
Spirit Lake	W. A. Sidda
Storm Lake	A. J. Bon
Tipton	J. M. Ride
Vinton	T. F. McCur
Villisca	Hon. J. S. Bo
Washington	Wm. A. Coo
Webster City	C. M. Trumbaue
Winterset	Will McKnigh
West Bend	Phil. Dorwei
Williams	M. L. Fulle

*U. S. Weather Bureau.

WEATHER-CROP OBSERVERS.

Reporting for the Weekly Bulletin.

Afton	M. V. Ashb
Agency	J. H. Van Zan
Albia	Wm. Merce
Alta	Hon. H. T. Saberso
Ames	Henry C. Wallac
Anita	H. T. Chapi
Ankeny	Ed. Parmente
Battle Creek	A. Presto
Bloomfield	Geo. Duffiel
Boone	L. C. Morri
Carbon	N. M. Kin
Carson	G. N. Ferguso
Centerville	Henry Galle
Charles City	W. B. Towne
Chariton	C. C. Bur
Clarksville	F. M. Russe
Corning	Jerome Smit
Clermont	Chas. Larrabe
Council Bluffs	L. Prout
Dedham	J. W. Ka
Danville	Sherman Matthew
Emerson	D. B. Nim
Ely	Hon. A. J. Fuhrmeiste
Fontanelle	W. H. Bridgma
Ford	W. W. Whitmor
Fort Dodge	R. W. Blain
Geneva	Wm. H. Thompso
Gosport	B. F. Bant
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Grinnell	A. O. Pric
Harlan	Fred Fische
Hesper	G. E. Dillinghar
Hodge	James Pipe
Hamlin	F. P. Moor
Humeston	Hon. S. H. Moor
Independence	C. L. Thoma
Indianola	T. B. Hamme
Jefferson	S. M. Tayl
Larrabee	H. H. Carnaha
LeMars	Hon. Henry Schroote
Ledyard	Frank Mille
Lawler	Hon. Wm. Gl - tl
Lockridge	John F. Farma
Manning	H. W. Polloc
Mapleton	A. Lam
Marshalltown	Hon. J. G. Brow
Mason City	Wm. Nettleto
Mt. Pleasant	W. S. Wrigh
Minburn	J. W. O'Brie
Mount Vernon	Robert Smit
Newton	J. P. Beatt
North English	J. L. William
Nevada	O. G. Ashfor
Osage	E. W. Stac
Orange City	H. J. VandeWa
Paton	Hon. Joshua Jeste
Pittsburg	G. C. Duffiel
Polo Station	A. E. Mille
Prescott	G. W. Ide
Paullina	Geo. Hakema
Rockwell City	J. G. Palme
Rock Rapids	D. E. F. Merri
Rossville	F. B. Wile
Sandusky	Z. Hollingswort
Sageville	Hon. F. N. Kno
Shenandoah	Reuben Mulliso
State Center	E. N. Thompso
Sumner	John Dawso
Tama	W. G. Mal
Van Horn	Spencer Smit
Wapello	O. P. Smit
Waukee	John Wrag
Wheatland	D. Beckma
Willow Creek	W. S. Nicholso
Winterset	H A. Kinsma
Wall Lake	I. E. Wilco
Walnut	F. L. Marti
What Cheer	O. D. Lawrenc

Met. 2

UNITED STATES DEPARTMENT OF AGRICULTURE

WEATHER BUREAU.

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MONTHLY REVIEW

OF THE

J. R. Sage,
Des Moines.

Iowa Weather and Crop Service.

VOL. IV.—AUGUST, 1893.—No. 8.

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CENTRAL STATION, DES MOINES, IOWA.

J. R. SAGE,
DIRECTOR.

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LOCAL FORECAST OFFICIAL,
U. S. WEATHER BUREAU, ASS'T DIRECTOR.

DES MOINES:
G. H. RAGSDALE, STATE PRINTER.
1893.

THE IOWA WEATHER AND CROP SERVICE.

Was established by act of the Twenty-Third General Assembly, and placed under supervision of the Board of Directors of the State Agricultural Society, constituted as follows:

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Vice-President—John A. Evans, West Liberty, Muscatine Co.
Secretary—John R. Shaffer, Des Moines, Polk Co.
Treasurer—C. B. Worthington, Des Moines, Polk Co.

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J. W. McMullin. John A. Evans, John R. Shaffer.

U. S. Department of Agriculture---Weather Bureau.

MONTHLY REVIEW

OF THE

IOWA WEATHER AND CROP SERVICE.

VOL. IV.] AUGUST, 1893. [No. 8.

EDITORIAL NOTES.

The drought has used up pasturage, and necessitated the feeding of stock two months earlier than usual. It is believed the pastures are beyond recovery the present year, and this extension of the feeding season will draw heavily upon the surplus of forage which Iowa was supposed to have in store. The stock will require the greater part of all the hay and other forage now on hand, and many farmers will be short if the winter should be excessively severe or long drawn out. Those who have cut their corn will be in luck.

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According to the director of the Physical Observatory of St. Petersburg, M. Wild, the coldest inhabited spot on earth is the village of Verkhoiansk on the Yana River in northeastern Siberia, about a hundred miles north of the Polar Circle, in latitude 67° 34'. The mean temperature for each month in this Arctic village, reduced to the Fahrenheit scale is about as follows:

January, 63⅓ deg. below zero; February, 51⅓ deg. below zero; March, 48½ deg. below zero; April, 4⅓ deg. above zero; May, 15⅓ deg. above; June, 49¼ deg. above; July, 56¾ deg. above; August, 43½ deg. above; September, 29¼ deg. above; October, 4⅓ deg. below zero; November, 40 deg. below zero; December, 57¾ deg. below zero.

The mean temperature for the whole year is 2¾ deg. below zero. For just six months the thermometer is below zero, and for the other six above.

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S. F. Walker, in an article in the *London Electrical Engineer*, discussing the question, What is electricity? says: "As far as the writer is able to understand the matter now, electricity is simply the motion of the molecules of the different substances which are the subjects of electrical action, just as heat, light and sound are, and the only difference between these forces is the rate of motion. The motion of sound, as we all know, is comparatively slow; that of heat and light very rapid. That of electricity would appear to be somewhere between the slow motion of sound and the rapid motion of the heat waves whose motion is the slowest (that is, slower than that of light). And it would appear that the wonderful adaptability which electricity shows for every kind of work is due entirely to the position which its rate of motion occupies in the scale of the energies. It would also appear that the reason this wonderful agent lay dormant for so many ages, and is even now only partially developed, is very largely, at any rate, because we have no sense which responds to the particular periods of vibration comprised within the electric range."

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Cherra Punji, in the Khasi Hills, Assam, British India, is the "pole of the greatest known rainfall." In other words, it is the wettest region on the face of the earth. Mr. Blandford, at a meeting of the London Meteorological Society, read a paper, entitled "Rainfall at Cherra Punji," in which he presented incontestable proof of the extreme moisture of the country in question. The records go back for nearly sixty-five years, but prior to 1872 are rather incomplete, there being several whole years in which no record was kept. Carefully compiled data from these weather journals, however incomplete as they are, prove that quite frequently during the summer, say from May to September, the rainfall for a single month ranges from 100 to 212 inches. Think of it! Nearly eighteen feet of precipitation in thirty days. Colonel Sir Henry Yule's register for the year 1841 shows that there were 264 inches of rainfall during the month of August. That was something phenomenal even for Assam, however, and is not taken into account in the deductions made above.—*St. Louis Republic.*

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Sweet corn has been a good crop in Iowa this year, and the canning factories have been doing a heavy business.

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Uniform cloud nomenclature has never been in general use even among scientists. When the system of international weather observations began an attempt was made to establish uniformity, and ten names of clouds were recommended by the Meteorological Congress, at Munich, in 1891. These names were as follows: Cirrus, for high white feathery clouds; cirro-stratus, for high thin sheets of white cloud; cirro-cumulus, for flocks of small, white, fleecy clouds; alto-cumulus, for flocks of large, rounded or fleecy clouds, white except here and there a dark shading; alto-stratus, for a grey or bluish sheet of cloud through which the sun or moon is dimly visible; cumulus, for

large, piled, white clouds with a flat base; strato-cumulus, for rolls or balls of grey clouds usually covering most of the sky; cumulo-nimbus, for shower clouds; nimbus, for the widespread rain cloud of general storms; and stratus, for low, flat dark clouds, or elevated fog. Measurements made at Blue Hill show that the cirrus averages five and a half miles high and moves with a mean velocity of nearly ninety miles an hour. The cirro-stratus averages five miles high; the cirro-cumulus, four and a half miles; the alto-stratus, three miles; the alto-cumulus, two miles; the cumulus, strato-cumulus, and cumulo-nimbus about one mile, the nimbus less than half a mile; and the stratus about a third of a mile. In general storms the clouds are so low as sometimes to almost touch the church steeples.—*New England Weather Bulletin.*

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A new Display Station has been established at Shenandoah, Iowa, under the management of Mr. J. M. Hussey. Mr. A. H. Roberts, Audubon, Iowa, will hereafter superintend the display of weather signals in place of Mr. J. W. Coquillette who has removed from the city.

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Mr. James E. Payne, a newspaper correspondent, after writing a graphic description of a Missouri tornado for a Kansas City paper, writes as follows about the proper name of the storm: "Now as to the nature of a tornado, for it is an unpardonable misnomer to call it a cyclone — one might call it a whirlwind, but that sounds all too tame Tornado is the word. It is a local storm of much intensity and destructive energy. No well informed writer would speak of it as a cyclone. A cyclone partakes of none of the features of a tornado. A cyclone is a vast, revolving storm, continental in its course and effects. At the center it is generally calm, whereas a tornado has more business energy at its center than at any other point. While the Mayview tornado was sweeping across Lafayette county at the velocity of 100 miles an hour and its whirling motion increased at times to 1,000, leaving death and destruction in its track, a cyclone was prevailing all over the Mississippi valley. The tornado in no place had a width exceeding 500 yards. The cyclone at the same time extended from Winnipeg in Manitoba to San Antonio, Texas, and from Indianapolis to Denver. At the cyclone center there was a calm with a barometric pressure of 29.10 inches. At Lexington the pressure was 29.30. It was the indraught of air into the great depression at the storm center along the perimeter of the isobaric of 29.30 that, striking the mound at Mayview, was converted into a whirlwind, a rotary storm, a tornado. Of course, other conditions favorable to tornadic energy prevailed. There was a violent electric tension. The atmosphere was abnormally humid, the temperature was high and the topography a positive agent."

A DESTRUCTIVE CYCLONE.

During the month of August the Atlantic coast was swept by cyclones of the West Indies' type. The first, and mildest of the series, struck the coast of Florida on the 20th, and passed rapidly along the gulf stream. The second appeared suddenly off Cape Hatteras on the 23d, and on the 24th raged with considerable violence from New Jersey to Massachusetts Bay, being quite destructive to shipping and the buildings at the sea-side resorts. This was closely followed by the most destructive cyclone that has visited that storm-swept coast within the past twenty-five years. The development of the storm in the West Indies was noted by the United States Weather Bureau on the morning of the 25th, and signals were ordered along the coast from Key West to Wilmington on the 26th.

The cyclone struck the coast of Florida on the 27th, raging with terrific force through eastern Georgia, South Carolina, North Carolina and Virginia, causing great loss of life and immense destruction of property in its pathway through those States. The loss of life on the islands and lowlands along the coast was caused mainly by the heavy waves, and the number of victims is computed to be more than a thousand. Thousands of buildings were wrecked, trees were broken or uprooted by the force of the hurricane, and the crops within a belt over a hundred miles were well nigh completely ruined. In the little town of Kernsville over 100 buildings were destroyed, The property loss is estimated at over ten millions. The storm was three days in passing from Florida to the Gulf of St. Lawrence, a distance of about 3,000 miles. The path of destructive force was from 300 to 500 miles wide, and the effects of the storm were observed in heavy gales on Lake Michigan at the west, and far out at sea eastward.

It was a veritable cyclone, and it should be noted that it differed widely and materially from the Pomeroy storm of July 6, which is so frequently miscalled a "cyclone." The Pomeroy tornado was less than 2,000 feet wide, its path was about sixty miles long, and the duration of its destructive force was about two hours. The eastern cyclone covered a belt 500 to 1,000 miles wide and 3,000 miles long, and it was in active operation four or five days. In Georgia and the Carolinas it raged nearly two full days.

It must be evident from the foregoing statement that we should have sense enough to invent different names for storms of so widely different magnitude and diverse characteristics. For convenience and accuracy of description the term cyclone has been applied to the greater disturbance, and the Spanish word tornado (from *tornar*, to turn or return) most graphically describes the whirling wind spouts and waterspouts frequently noted on land and sea. The two things are as much unlike as an elephant and a mosquito.

The people of the east know by experience something of the vast breadth and general destructiveness of a cyclone. And when they read in the western papers and our press dispatches that some Iowa, Missouri or Kansas town or farming section has been struck by a "cyclone," they are impressed with the idea that the western people are most awfully tempest-tossed and greatly to be pitied.

Our prairies are occasionally plowed by small-bored tornadoes, but they are mere pin scratches compared with the immense sweep of the cyclones which are born of the heat and moisture of the tropical waters. Tornadoes occur at the east and south as well as in the west, but the Mississippi valley is happily exempt from the cyclones and hurricanes of the West Indies' type.

GOVERNMENT CROP REPORT.

The September report of the statistican of the department of agriculture shows a decline in the condition of corn to 76.7

per cent from 87. The change is marked in nearly all the surplus corn States. The present condition is 75 per cent in Kentucky, 64 in Ohio, 65 in Michigan, 59 in Indiana, 64 in Illinois, 96 in Iowa, 92 in Missouri, 74 in Kansas and 71 in Nebraska. In comparison with September reports for the past ten years only three were lower. There has been a general decline in the condition throughout the country, which has been caused by the prevailing drought.

The estimated crop of corn in the seven surplus States as compared with last year, is as follows:

STATE.	1893.	1892.
Ohio	66,073,000	88,853,000
Indiana	74,830,000	103,334,000
Illinois	147,853,000	165,327,000
Iowa	253,285,000	200,221,000
Missouri	173,507,000	152,489,000
Kansas	170,886,000	145,825,000
Nebraska	162,865,000	157,145,000
Total seven States	1,049,234,000	1,008,194,000
Grand total	1,600,000,000	1,628,464,000

The condition of wheat, considering both winter and spring varieties, when harvested was 74 per cent, against 85.3 in 1892.

The general average is the lowest since 1885, when it was 72 per cent. The reported conditions from correspondents from the principal wheat-growing States are as follows: Ohio 98 per cent, Michigan 80. Indiana 83, Illinois 60, Wisconsin 80, Minnesota 65, Iowa 85, Missouri 64, Kansas 42, Nebraska 55, South Dakota 66, North Dakota 67, Colorado 89, Oregon 93 In the eastern and most southern States the crop was harvested in good condition and the yield averaged well, while in Illinois, Missouri, Kansas and Nebraska the yield was small and of inferior quality. Much of it graded at No. 3 and under, and in some places is reported to be worthless.

In the Dakotas the yield is light, while the quality is generally good. In Iowa and Wisconsin the winter variety yielded well and was of good quality, while the spring variety yield was poor and of inferior quality. In Minnesota the yield was poor and not up to expectations, the quality being generally good, with some complaint of shrivelled grain. In California and Oregon the quality of grain is good, up to the average, and the yield has been good, except on the low lands, where it was greatly damaged.

There has been a further decline in the condition of oats during the past month, the general average standing at 74.9 against 78.3 in August.

Barley shows a slight falling off since last month, the general average being 83.8, against 84.6 in August.

The condition of potatoes is 71.8 a decline of over 14 points since the August report.

A NEW TORNADO THEORY.

Mr. E. D. Titus, president of the National Chemical Company, a gentleman who has had thirteen years' pratical experience as a telegraph manager, and twenty-five years of observation of electrical disturbances, recently gave an interesting talk in the columns of the Minneapolis *Tribune*, relating to the so-called "cyclones." His views as to the nature and origin of tornadoes were called forth by a communication in that paper in which the prediction was made that the coming generations of man will be compelled to dwell in caves to avoid the increasing electrical disturbances upon earth in the form of "cyclones." His theory is somewhat novel and interesting if not quite convincing.

"The popular belief," said Mr. Titus, "that electricity is the cause of cyclones (tornadoes) is an error. All chemical action is based upon the operation of the law of heat and cold. There can be no chemical action without heat. A drop of water coming in contact with a piece of iron cannot oxidize into the oxide of iron rust without generating a certain amount of heat. It is the operation of the law of heat and cold that causes the ocean currents. Cold water is heavier to the square inch than warm, hence the cold arctic currents follow the deep sea beds and channels toward the equator, dispersing and forcing the lighter warm water to the surface and to the poles, where in turn it becomes cooled, returning again to the equator through the deep sea beds. The same law that governs the water of the earth governs also the air. Air and water are both liquids. The air can be seen to flow like water by holding a sharp piece of glass in a strong current of air.

"From the Gulf of Mexico to the north pole and from the lakes to the Rocky mountains is a vast extent of country crossed by no mountain chains to intercept or retard the velocity of air current. The extent of this country is equaled by none on earth. Colder air being heavier to the square inch than warm air, the cold air, when coming in contact with a warm current from the south, always predominates, forcing the warm air into the upper currents.

"The cause of cyclones is the meeting of a head wind from the north with a head wind from the south. They meet like two vast armies of men. The pressure at the point of meeting is so great that the air, by compression, becomes heavier to the square inch than wood, or the human body, hence either one will float in the same manner that wood will float in water—it floats because it is lighter to the square inch than water. Place water in an ordinary wash bowl and remove the plug and it will be observed that in passing out the water forms a circular reaction. Air being a liquid does the same in passing either upward or downward; hence the funnel-shaped spout of the cyclone center. When two immense bodies of air coming from opposite directions meet, the only egress is upward and side ways, and in passing upward it forms the funnel the same as water passing out of a wash bowl downward. The theory that a cyclone forms a vacuum is absurd. Withdraw air from a glass jar with an air pump, and a feather within the vacuum formed will drop with the same velocity as lead, or, on the other hand, you can compress air until it is heavier to the square inch than wood, in which case wood will float in the air. The lifting power of a cyclone is caused first by the compression or density of the air, and second by its velocity. Combining the power of density with that of velocity, which occurs at the center or funnel, no power can resist it. The feeling of suffocation or difficulty in breathing when near the track of a cyclone is caused from the compression of air.

"Several years ago a cyclone picked up a man and his wife, each having a child in their arms. They floated along together for the first mile or two and then separated. The husband was dropped to the ground lightly without the slightest injury either to himself or child, while the wife, drifting into rarified air, dropped with great force and was killed. Had they been

carried in consequence of the velocity of the wind they would have been carried at a speed of not less than 100 miles per hour, and destruction to both would certainly have followed. They simply floated in consequence of the density of the air. In olden times unexplained phenomena were attributed either to the gods or the intervention of divine providence. At the present day many would-be scientists lay what they cannot explain to the doors of electricity. Electricity has no lifting power except in connection with the dynamo or helix; in other words, except when harnessed by man.

"Several years ago a cyclone picked up two spans of the railroad bridge across the Missouri river at Omaha. They have never been found, being probably dropped into the quicksands of the river and passing from sight forever. I was in the capacity of train dispatcher at the time, sending orders to a stock train at Kearney, Neb. The carrying away of the two spans of the bridge broke the wires and disconnected the main batteries. There was no more electricity in the air at that moment than is experienced in an ordinary thunder-storm. Had there been it would have interfered with the working of the wires. On the contrary, however, the electric disturbance was so slight that it did not interfer with telegraphic communication with the west, and I did not learn the accident to the bridge for some time afterward, althongh it was scarcely a mile distant. Soon after this occurrence a certain Professor Tice, of St. Louis, wrote a long-winded article on the subject, attributing the cause to electricity. He might as well have charged it to the heathen gods. I was working the identical wire passing over that identical bridge at that identical moment, and I know from practical knowledge that no unusual electrical forces were at work in the air. A person who has given electricity any thought can tell from his own feelings whether the air is heavily charged or not, but if in doubt, he can easily settle the question by rubbing his fist over a piece of paper placed upon a table or smooth board. If the air is heavily charged the paper will become charged and stick to any object, the wall or ceiling.

"To avert cyclones," says Mr. Titus, "plant trees. If each farmer would cultivate a line of trees running east and west along his south section line it would break the velocity of the winds near the ground and force the cyclones into the upper air currents."

FOREST INFLUENCES.

The subject of the relation of forests to climate is one which has been much discussed and upon which much has been written. In all countries there have been writers who have claimed that there exists an intimate relation between forests on the one hand and climate and water-flow on the other; and deforestation has been held up as the cause, not only of destructive floods and inundations, but also of changes in the climates of different regions. Of late years the question has been removed from the vague field of mere individual opinion and popular belief on to the firmer basis of experiment and scientific research, and the careful and systematic work of forest meteorologists in Germany, France and other European countries has already produced most valuable results. The literature of the subject has increased very rapidly in the last few years, and it has become a difficult matter to keep informed of the recent advances of this most attractive branch of science. We have ourselves, in our endeavor to keep abreast of the times in current meteorological literature been unable, through lack of time, to inform ourselves as to the present status of forest meteorology, and we have long been wishing for a systematic summary of forest meteorological observations. It is, therefore, with a feeling of great satisfaction that we have received and read the latest Bulletin of the Forestry Division of the Department of Agriculture. The subject with which this Bulletin deals is Forest Influences. The main part of the publication is a systematic and carefully prepared Review, by Prof. Mark W. Harrington, the Chief of the Weather Bureau, of the forest meteorological observations made at the various stations in Europe. This summary will, we are sure, be most welcome reading to all meteorologists in this country who have, like ourselves, been unable to keep up with the growing literature on this subject. Prof. Harrington has given much study to this branch of meteorology and his paper shows his thorough acquaintance with the subject. The results of his investigations are presented in a series of graphic illustrations which add much to the value of the summary.

The history of systematic observations in forest meteorology is followed from the year 1796, when Pictet and Maurice took observations of tree temperatures at Geneva, down to the most recent published records, the objects and methods of the work being carefully stated. The real beginning of systematic observations, which was the direct incitement to modern activity in this direction, was made by Becquerel, at Chatillon-sur-Loing, seventy miles from Paris, on July 30, 1858, and these observations have been kept up continuously since then. In 1868 Dr. Ebermayer, whose name is intimately associated with forest meteorology, began his work, and in 1875 the German meteorological forestry service was established. Sweden started a system of observations in 1876, and Austria in 1884. With the growth of Agricultural Experiment Stations in the United States we hope soon to see a system of similar observations established all over this country, which, with its broad extent of territory, offers exceptional advantages for any such investigation.

The number of points brought out in Prof. Harrington's review is so great that we can only refer to a few of them. In considering this subject it must be remembered that no influence upon the general climate can be expected, but only local modifications of climatic conditions may be anticipated. As regards the influence of forests upon temperature it is seen that the general influence upon soil temperatures is a cooling one, due to the shade and to the fact that moisture is retained longer in the forest floor as well as in the air of the forest, the evaporation of this moisture being necessary before the ground can be warmed. The annual range of temperature is smaller in the forest than in the open, the range of temperature being more affected than the average absolute temperature. In the tree-tops the mean temperature, after correcting for elevation, is rather higher than over open fields. The connection of forests and humidity is an important one. The average annual evaporation within the woods is about forty-four per cent of that in the fields, and the percentage of rainfall evaporated at the surface of the ground is about twelve per cent for the whole year for the forest and about forty per cent for the open fields. The relative humidity is two to four per cent larger in the forest than over the plains. The question as to whether the rainfall over forests is really larger than that over open fields still remains unsettled.

The influence of forests upon the climate of the surrounding country can only take place by means of the diffusion of vapor which is transpired and evaporated by the crowns, and by means of air currents passing through and above forests, whereby they may be modified in temperature and moisture conditions. Forests have some effect in the local air currents which they cause, similar to those caused by a lake or a pond, cool currents coming from the forest by day in the lower strata, and warm currents by night in the upper strata. This circulation is not noticeable in winter. Deforestation, by removing an obstacle to the movement of the winds, may permit destructive blasts which the previously existing forests prevented. One of the most important questions, however, as to the influence of forests on the rainfall of neighboring areas, is still unsettled.

Mr. Fernow's paper on the Relation of Forests to Water Supplies deals with a question in which the facts are pretty well established. Deforestation increases and accelerates evaporation, and so unfavorably affects the size and continuity of springs. Forests favor subterranean rather than surface drainage, owing to the channels furnished by the dead and living roots, and the loose and porus character of the soil. In this way, and by retarding surface drainage by the uneven forest floor, forests tend to give a constant and equable flow of water and to prevent floods. A short note by Dr. Fernow on the Sanitary Influences of Forests brings out the facts that the protection against sun and wind, the equable conditions of forests, make them desirable locations for sanitaria, and that the soil conditions of forests are unfavorable to the production of pathogenic microbes, such as those of cholera and yellow fever. The calmer atmosphere and the absence of dust are further important features from a sanitary point of view. There seems to be no very good foundation for the general belief that forests have purer air than open fields, owing to the greater production of oxygen and ozone.

"We may summarize," says Mr. Fernow in his introduction, "that the position of the forest as a climatic factor is still uncertain, at least as to its practical and quantitative importance, but that its relation to water and soil conditions is well established. As a climatic factor it would appear that the forest of the plains is of more importance than that of the mountains, where the more potent influence of elevation obscures and reduces in significance the influence of the forest cover; as a regulator of water conditions the forest of the mountains is the important factor; and since this influence makes itself felt far distant from the location of the forest, the claim for attention of Government activity and for statesmanlike policy with reference to this factor of national welfare may be considered as well founded. Every civilized government must in time own or control the forest cover of the mountains in order to secure desirable water conditions."

In the appendix Prof. Abbe takes up the question of the determination of the True Amount of Precipitation and its Bearing on Theories of Forest Influences, and shows how difficult it is to obtain accurate records with the guages in general use. His paper is a clear presentation of the subject and serves as a warning against basing any very definite conclusions on the amount of rainfall collected in the usual way.

Taken as a whole this Bulletin is worthy of careful consideration, not only on the part of all persons who are in any way interested in the subject of forestry and the effects of deforestation on water supply, a question which is destined to attain considerable prominence in this country before long.—*American Meteorological Journal, Sept. 1893.*

THE SONG OF THE CORN.

I am Beauty's priest in the summer days,
When lily and rose are born;
And the fair world yet is fairer,
For the springing of the corn.

Oh, tall and strong and beautiful
I stand in my serried shades;
And the poet dreams, as the sunlight gleams
On the green of my waving blades.

And the painter flings his brush by;
For what can his colors do
With the lights and shades on my leafy maize,
When the breeze goes wimpling through?

The hand of a sculptor never made
A shaft more straight and fine
Than my tasselled stem, where the gold silk hangs,
And the morning-glories twine.

And never a strain from the strings of harp,
Or the throat of bird at morn,
Holds more of music's very soul
Than the wind on a field of corn.

But the realm of Art is a little part
In the world of man's endeavor:
And above the song of wind and bird
A murmur soundeth ever.

And I see through the glory of summer skies
Men's faces gaunt and wild;
And mournful clear, I seem to hear
The wail of a hungry child.

And oh! for a voice to sound above
The wind and the wild bees' humming,
To answer the cry of God's famishing ones
"Be patient, for I am coming."

Then I thrill with the joy of giving,
And I welcome the autumn's cold
That ripens the ear in my folded husks,
And turns my green to gold.

Servant of God and servant of man!
I smile at the reaper's knife,
And give my part with a willing heart—
My life for humanity's life.

Oh! better than summer's rapture
The joy that winter yields,
When December's moon shines coldly
On the sad deserted fields.

Where bereft, alone, I proudly stand,
A soldier that will not swerve—
A mailed knight in armor bright
Whose motto is, "I serve."

—*Elisa Calvert Hale, in The Arena.*

IOWA CORN.

The corn exhibit of Iowa at Chicago is prominent. We hope it will have a satisfactory effect on ourselves. The most good that can come of it will be to set us thinking how valuable it is to use in Iowa and at what price we can afford to sell it to anybody. It will be worth all the money Iowa gave the State commission to represent the State to have Iowa farmers study their own great corn crop. It is a wonderful lever in money

making through meat making and dairy product making, horse growing and poultry producing. It is the one best feed of the Nation. It is worth big figures when turned into first-class products and it is a high figure we would ask for a bushel raised by us. We never sold a bushel and cannot be brought to consider the sale of one. It is the medium by which the thoughtful farmer makes wealth. It is the feeding force that enables the State of Iowa to defy all competition in producing high selling farm goods, and monopolize gradually the growing of fine animals and the making of superior dairy products It calls upon the atmosphere for a large per cent of its nutrition and is moderate in its demand on the soil. It is not perfect as a feeding stuff, but farmers are supposed to attend to that. Iowa is said to have nothing so prominent at the fair, but corn prominence suggests to a good farmer prominence in all things.—*Prof. Jas. Wilson.*

AUGUST WEATHER REPORT.

The mean temperature of the month, 69.4°, is about 1.6° below the August normal for the State. The temperature in the last week of the month reached the frost line on three mornings, but no damage resulted except on low lands in some northern counties. On the whole the weather was favorable for the crops, except a general deficiency of moisture in the last half of the month. At the close of the month the drought was being seriously felt in nearly all sections, materially shortening the potato crop and late planted corn. The average rainfall for the State was 2.32 inches, which is about 1.25 below the normal amount.

The month was generally exempt from destructive wind storms. At Sioux City, on the 23d, 2.08 inches of water fell in about 50 minutes, causing considerable loss by washouts and overflows, filling basements and damaging goods.

The following table gives, as a basis of comparison, the mean temperature and total rainfall for the month of August, at the stations named for the years from 1872 to 1893 inclusive:

YEARS.	MEAN TEMPERATURE, DEGREES.						PRECIPITATION, INCHES.					
	Des Moines.	Davenport.	Dubuque.	Keokuk.	Omaha.	Sioux City.	Des Moines.	Davenport.	Dubuque.	Keokuk.	Omaha.	Sioux City.
1872	....	74	....	77	75	....	....	9.38	....	0.97	1.78	....
1873	....	78	74	78	76	....	....	0.51	5.88	0.54	1.60	....
1874	....	74	74	75	78	....	....	3.68	2.13	3.87	2.08	....
1875	....	69	70	70	70	....	....	1.73	1.07	3.83	7.77	....
1876	....	75	74	76	74	....	....	4.27	5.92	4.03	6.27	....
1877	....	72	72	74	72	....	....	3.21	3.06	2.52	3 13	....
1878	78	74	74	78	76	....	2.21	5.07	1.72	5.27	2.48	....
1879	73	72	72	75	75	....	1 98	4.33	2.43	4.57	1.51	....
1880	72	75	73	78	76	....	6.69	5.90	7.15	3.81	7.10	....
1881	78	77	74	80	80	....	5.20	0.83	2.46	0.86	1.65	....
1882	71	72	72	73	73	....	3.14	2.29	2.29	3.09	0.95	....
1883	70	70	68	71	72	....	2.83	1.02	2.70	1 32	3.39	....
1884	69	70	68	72	70	....	3.84	3.84	4.25	2.74	7.07	....
1885	69	68	66	71	70	....	5.10	12.68	8.02	5.98	4.53	....
1886	77	74	74	78	72	....	1.10	2.67	0.67	5.90	2.53	....
1887	72	72	71	75	72	....	2.66	3.23	4.40	2.38	3.94	....
1888	69	70	69	72	72	....	4.52	2.79	1.73	2.07	3.44	....
1889	72	72	72	73	74	73	2.25	1.11	0.26	0.95	2.90	1.19
1890	70	70	69	71	70	69	3.35	1.66	6.00	1.77	1.02	3.64
1891	70	70	70	71	72	70	4.22	5 54	3.31	6.10	2.02	3.54
1892	72	73	73	75	73	72	2.45	1.53	2.51	1.07	2.50	4.14
1893	70	72	71	72	71	70	1.60	1.12	0.58	1.16	3 62	5.85
Means....	72	71	72	73	73	71	3.33	3.73	3 44	2.97	3.30	3.67

SUMMARY OF WEATHER CONDITIONS.

BAROMETER—Mean pressure for the month, 30.00 inches. Highest observed, 30.32 at Clarinda, on the 30th. Lowest observed, 29.66 inches at Sioux City, on the 9th. Range for the State during the month, 0.66 inches.

TEMPERATURE—Monthly mean as determined from 71 Voluntary Observer's reports, 69.4°. Highest monthly mean, 74.4° at Washington; lowest monthly mean, 64.4° at Sac City. The highest temperature reported was 101° at Bonaparte on the 9th. The lowest temperature reported was 30°, at Elkader, on the 30th. Average daily maximum, 82.4°; average daily minimum, 56.3°; average monthly maximum, 95.1°; average monthly minimum, 41°; greatest monthly local range, 68° at Emmetsburg. Range for the State, 71°.

PRECIPITATION—Average for the State as determined from 73 Voluntary Observer's reports, 2.32 inches. Greatest amount reported, 6.22 inches, at Clinton. Least amount reported, 0.40 inches, at Algona. Average number of days on which .01 or more inches rain fell, 5; cloudy days, 3; clear days, 19. partly cloudy, 9.

AURORAS—Des Moines, 6th; Keokuk, 6th; Cedar Rapids, 5th; Audubon, 6th; Charles City, 6th; Amana, 6th; Alta, 5th, 6th, 11th, 18th; Centerville, 6th, 18th.

FROSTS—Charles City, 29th, 30th; Des Moines 5½ miles sw on the 30th; Eagle Grove, 29th; Ames 29th; Emmetsburg 21st, 29th, no damage; Cresco, killing on 27th; Alta, 28th, 29th. Light frosts doing no damage reported quite generally throughout the State on the 29th, 30th. Damage is confined to Howard, Floyd, Mitchell and Worth counties. Solar Halo, Hopeville, 1st, 14th, 19th, 21st.

THUNDER STORMS were general on the 8th, 10th, 14th and 21st.

METEOR—Amana, 13th; Elkader, 8th.

HAIL—Ovid on the 8th; Richland, 10th.

PARHELIA—Ovid, 1st.

HEAVY FOGS—Rock Rapids, 23d.

ATMOSPHERIC PRESSURE.

STATIONS.	Mean reduced barometer.	EXTREMES.			
		Highest barometer	Date.	Lowest barometer	Date.
Cresco	30.00	30.21	30	29.78	23
Clarinda	30.02	30.32	30	29.81	10
Cedar Rapids	29.97	30.21	30	29.78	10
Davenport	30.00	30.28	30	29.80	16
Des Moines	30.01	30.30	30	29.78	23
Dubuque	29.99	30.26	31	29.77	10
Keokuk	30.00	30.27	30	29.82	16
Omaha, Neb	30.01	30.31	30	29.76	9
Sioux City	29.97	30.28	30	29.66	9
Means	30.00	30.32	..	29.66	....

EXCESSIVE RAINFALL.

The following heavy rainfalls were reported during the month:

Clarinda (Page county), from 6:00 P. M. of the 14th to 8:00 P. M. of the 15th, 5.60 inches.

Corning (Adams county), 2.75 inches in 24 hours on the 14th and 15th.

Murray (Clarke county), 3.65 inches in 24 hours on the 14th and 15th.

Villisca (Montgomery county), 3.87 inches on 14th and 15th.

Sioux City, on 23d, 2.08 inches within 50 minutes.

WIND MOVEMENT.

STATIONS.	Miles.	Maximum velocity.	Direction.	Date.
Davenport	44.25	28	NW	10
Des Moines	43.73	63	SW	10
Dubuque	30.76	24	NW	10
Keokuk	32.95	22	W	10
La Crosse, Wis	44.29	22	W	24
Omaha Neb	43.82	34	SW	14
Sioux City	65.37	50	NW	23

OBSERVERS NOTES.

Muscatine—J. P. WALTON: This has been the dryest August for twenty years, and the dryest on record with but two exceptions. The rainfall was 1.02 inches; the highest temperature was 95° and the lowest was 41°. The mean was 69.8°—a little cooler than the average. There were but two rainy days, and one cloudy day. Corn, potatoes and pastures have been greatly damaged.

DELAYED METEOROLOGICAL REPORTS.

The following reports were received too late for publication in last month's REVIEW.

HOPKINTON—July: Mean temperature, 76.5°; maximum, 92°, on the 25th; minimum, 61°, on the 27th. Rainfall, 2.75 inches. There were six rainy days, and thunder storms occurred on six days.

MAXON—July: Mean temperature, 77.8°; maximum temperature, 98°, on the 13th; minimum, 64°, on the 4th. Rainfall, 2.88 inches. Number of clear days, 18; partly cloudy, 13; cloudy, 0; rainy, 6.

LARRABEE—July: Mean temperature, 74°; maximum temperature, 96°, on the 12th; minimum temperature, 50°, on the 30th. Range for the month, 49°. Rainfall, 1.95. Prevailing direction of the wind, south. Rain fell on 7 days; one thunder storm.

PANAMA—July: Mean temperature, 74.3°; maximum temperature, 96°, on the 12th; minimum temperature, 51°, on the 3d. Rainfall, 3.98 inches. Number of clear days, 15; part cloudy, 4; cloudy, 12; days on which .01 or more inches rain fell, 10. Prevailing direction of wind, south.

COUNCIL BLUFFS—July: Mean temperature 78.1°; max. temp., 100° on the 12th; min. temp. 55° on the 3d; mean max., 91.5°; mean min., 64.5°. Total rainfall, 4.56 inches. Greatest amount in 24 hours, 1.66 inches on the 4th.

OSAGE—July: Mean temperature, 71.3; total precipitation, 4.08 inches; rainy days 9.

HAWKEYE—July: Rainfall, 1.68 inches.

FAYETTE—Mean temperature for May, 54.0°; maximum temperature, 83° on the 19th and 21st; minimum temperature 28° on the 4th. Rainfall for the month, 3.35 inches. Number clear days, 12; part cloudy, 9; cloudy, 10; .01 or more rain fell on 10 days. Prevailing wind from the northwest.

FAYETTE—Mean temperature for April, 42.7°; maximum temperature, 78° on 3d; minimum, 19° on 23d. Rain for the month, 3.73 inches. Number of clear days, 2; part cloudy, 9; cloudy, 18. Rain fell on 10 days. Thunder storms on 3 days.

FAYETTE—Mean temperature for June, 69.6°; maximum temperature, 93° on 19th; minimum, 40° on the 7th. Rainfall during the month, 3.45 inches. Number of clear days, 14; part cloudy, 11; cloudy, 5. Rain fell on 7 days. Prevailing wind from the southwest.

OSAGE—June: Mean temperature, 66.1°. Total rainfall, 2.28 inches. Number rainy days, 5.9.

METEOROLOGICAL DATA FOR AUGUST, 1893.

STATIONS.	TEMPERATURE OF THE AIR (IN DEGREES FAHRENHEIT).								PRECIPITATION IN INCHES.			Prevailing direction of wind.	No. of cloudless days.	No. of partly cloudy days.	No. of cloudy days.	No. of rainy days. (.01 inch or more).	No. of hail-storms.	No. of thunder-storms.
	Monthly mean.	EXTREMES. Mean maximum.	Mean minimum.	Maximum.	Date.	Minimum.	Date.	Monthly range.	Monthly.	Total monthly snowfall.	Depth of unmelted snow at end of month.							
Algona	68.5	...	...	96	8	46	29	50	0.40	....	.....	SW	21	10	0	...	...	...
Alta	68.5	81.7	55.2	95	8	40	29	55	1.73	....	.....	S	18	11	2	9	...	8
Ames (W. R. Cooper)	68.0	83.1	53.0	97	8	38	29	59	1.62	....	.....	SE	23	5	3	4	...	...
Ames (four miles southwest of)	72.5	.....	...	98	8	40	29	58	1.08	....	.....	SW	10	8	13	6	...	...
Amana	69.4	82.6	56.2	96	9	39	30	57	3.02	....	.....	W	22	8	1	5	...	...
Audubon	71.4	86.2	56.7	97	9	36	30	61	1.98	....	.....	S	2	24	5	6	...	...
Belle Plaine	69.2	82.5	55.8	97	9	40	30	57	1.99	....	.....	NW	20	7	4	5	...	12
Blakeville	72.1	.....	...	96	9	49	30	47	1.12	....	.....	NW	14	7	10	2	...	...
Bonaparte	71.6	87.9	55.2	101	9	40	30	61	2.02	....	.....	.....	...	...	...	...	...	...
Carroll	68.5	80.9	50.1	94	8	38	30	56	2.92	....	.....	.....	23	3	5	8	...	4
Cedar Falls	70.0	86.6	53.4	96	8	36	30	60	1.09	....	.....	NW	25	4	2	5	...	...
Cedar Rapids	70.2	80.5	60.0	92	9	45	30	47	2.47	....	.....	NW	25	4	2	3	...	...
Centerville	73.0	85.4	60.6	97	9	44	30	53	3.20	....	.....	NW	24	6	1	2	...	...
Charles City	68.5	80.5	56.6	96	8	36	29	60	1.20	....	.....	NW	...	...	...	4	...	...
Clarinda	69.6	79.7	59.2	92	8	44	30	58	6.22	....	.....	S	25	2	4	6	...	...
College Springs	*68.0	79.8	56.2	90	7	42	30	58	3.54	....	.....	S	23	6	2	3	...	...
Clinton	*70.5	85.4	55.7	96	10	40	30	56	1.20	....	.....	NE	13	17	1	2	...	...
Corning	67 7	79.5	56.2	90	8	40	30	50	6.16	....	.....	SW	23	4	4	2	...	...
Cresco	67.4	80.1	54.7	94	8	38	29	56	1.20	....	.....	SW	22	8	1	6	...	3
Davenport	70.0	83.9	60.4	94	9	46	27	48	1.12	....	.....	NW	13	13	5	4	...	...
Delaware	66.9	.....	.....	96	10	46	29	50	1 06	....	.....	S	22	7	2	6	...	...
Denison	.....	.....	.....	.....	...	.....	...	...	3.79	...	.....	.....	...	...	...	6	...	...
Des Moines	70 0	81.7	58.4	94	8	42	30	52	1.60	....	.....	N	15	15	1	8	...	1
Des Moines (4½ miles southwest of)	69.0	80.9	57.2	94	8	40	30	54	1.49	....	.....	NE	12	16	3	4	...	2
Dubuque	71.0	72.2	59.4	95	9	44	30	51	0.58	....	.....	NW	16	13	2	3	...	...
Eagle Grove	67.0	.....	.....	90	8	38	29	52	.....	....	.....	.....	...	...	...	...	...	...
Elkader	67.4	84 6	52 0	98	8	30	30	68	0.83	....	.....	N	23	8	0	3	...	12
Emmetsburg	68.6	83.6	53.5	97	8	39	29	58	2 36	....	.....	SE	23	2	6	4	1	1
Estherville	65.8	79.3	52.3	95	8	35	29	60	1.79	....	.....	.....	12	17	2	6	...	...
Ft. Madison	74.3	.....	.....	95	10	52	31	43	.....	....	.....	NE	19	7	4	2	...	...
Fulton	68.9	.....	.....	.....	...	.....	...	...	1.12	....	.....	SW	...	...	...	...	...	...
Galva	68.3	82.0	56.6	95	8	37	29	58	2.96	....	.....	SW	...	...	...	8	...	...
Glenwood	73 6	86.0	61.1	98	17	42	30	56	3.85	....	.....	S	...	...	...	6	...	...
Grand Meadow	66.8	.....	...	90	8	42	29	48	1.70	....	.....	SW	17	14	0	4	...	...
Greenfield	70.0	82.7	57.3	96	8	40	29	56	3.92	....	.....	NW	26	1	4	7	...	4
Grundy Center	68.4	81.5	54.8	96	8	38	28	58	1.56	....	.....	NW	18	12	1	6	...	2
Hampton	68.3	82.0	54.7	96	8	37	28	59	1.15	....	.....	NW	19	11	1	5	...	4
Hopeville	70.0	80.7	59.4	92	8	45	29	47	3.40	....	.....	S	9	21	1	7	...	4
Hopkinton	71.0	.....	...	92	9	45	29	47	1.25	....	.....	.....	...	...	...	2	...	...
Humboldt	.....	.....	...	.....	.....	.....	...	...	2.13	....	.....	S	18	10	3	8	...	1
Independence	67 9	.....	.....	.....	...	.....	...	...	0.75	....	.....	.....	...	...	...	2	...	...
Iowa City	70 3	83.3	57.4	94	9	45	12	49	1.64	....	.....	N	16	9	6	2	...	...
Iowa Falls	67.8	81.6	54.0	97	7	37	29	60	0.95	....	.....	SW	27	1	3	4	...	...
Jefferson	69.2	84.9	53 4	96	8	37	29	59	1 76	....	.....	SE	13	18	0	8	...	...
Knoxville	70.2	82.8	57.0	97	8	42	30	55	3.41	....	.....	SE	14	12	5	4	...	...
Keokuk	72.0	84.0	61.0	94	9	49	29	45	1.16	....	.....	N	21	9	1	4	...	12
Keosauqua	72.2	85.7	58.6	97	8, 9	43	30	54	2.26	....	.....	.....	...	...	...	4	...	...
Larrabee	68.5	83.2	53.7	96	8	35	29	61	2.18	....	.....	.....	...	...	...	...	...	6
Logan	70.0	84.3	55.6	94	8	37	29,30	57	1.99	....	.....	S	23	1	7	5	...	...
Maquoketa	69.3	.....	.....	96	10	52	30	44	1.62	....	.....	.....	...	...	...	5	...	...
Marshalltown	69.7	80.2	59.2	92	10	43	29	49	2.43	....	.....	S	26	5	0	3	...	...
Mason City	67 0	80.5	53.4	93	8, 9	34	29	59	1.83	....	.....	.....	16	0	15	5	...	...
Maxon	71.6	.....	.....	.....	...	.....	...	...	3.42	....	.....	.....	15	15	1	3	...	...
Mechanicsville	67.8	80.3	55.3	92	10	42	29	50	2.90	....	.....	NW	18	10	3	4	...	...
Monticello	68 2	80.7	55 7	95	10	39	30	56	1.23	....	.....	.....	25	5	1	2	...	...
Mt. Ayr	72.0	84.3	59.7	94	5	43	29	51	3.98	....	.....	.....	...	...	...	5	...	...
Murray	.....	.....	.....	.....	...	.....	...	...	5 73	....	.....	.....	18	3	10	5	...	...
Newton	70.0	82.7	57.2	95	8	43	30	52	3.35	....	.....	NW	16	10	5	6	...	...
Osage	64.4	.....	.....	.....	...	.....	...	...	2.57	....	.....	.....	...	...	...	5	1	3
Oskaloosa	70.1	83.6	56.5	99	8	39	30	60	1 69	....	.....	SE	24	6	1	6	...	...
Ovid	70.9	.....	.....	96	5	42	29	54	3.53	....	.....	.....	...	...	...	7	1	4
Panama	68.4	81.7	55.1	94	7	40	30	54	2.32	....	.....	SW	23	4	4	6	...	...
Richland	70.1	.....	.....	100	9	43	29	57	1.91	....	.....	.....	14	15	2	4	1	...
Rock Rapids	68.2	84.5	51.9	94	8	34	28	60	1.24	....	.....	S	10	20	1	6	...	4
Sac City	64.2	81.6	56.6	95	9	39	29	56	2.05	....	.....	SW	18	5	8	4	...	1
Seymour	70.2	84.0	56.3	98	8	42	30	56	4.67	....	.....	S	26	3	2	4	...	...
Sibley	66.4	81.4	51.4	92	8	35	29, 30	57	2.26	....	.....	SE	18	9	4	5	...	...
Sioux City	70.7	82 7	58.4	94	7, 8	42	30	52	5.85	....	.....	S	17	10	4	11	...	...
Storm Lake	71.0	82.7	59.3	94	8	44	29	50	1.90	....	.....	SW	20	9	2	8	...	7
Villisca	70.1	80.0	60.1	91	6	42	30	49	6.32	....	.....	.....	...	...	...	6	...	...
Vinton	69.1	.....	.....	94	9	41	30	53	1.40	....	.....	NW	25	4	2	2	...	1
Washington	74.4	.....	.....	89	9, 10	47	29, 30	51	1.65	....	.....	NE	...	...	...	...	...	...
Webster City	68.7	.....	.....	99	8	40	29	59	2.90	....	.....	SE	21	9	1	5	...	4
West Bend	67.0	.....	.....	92	9	43	29	49	1 28	....	.....	S	22	5	4	4	...	1
Williams	68.4	.....	.....	96	8	.....	...	...	1.79	....	.....	S	16	13	2	6	...	...
Winterset	70.8	84.1	57.5	100	8	43	29	57	2.91	...	.....	NW	12	11	8	6	...	...
Mean	69.4	82.4	56.3	95.1	.....	41.0	.....	54.3	2.32	....	.....	.....	19.2	8.8	3.4	5.0	4	3.3

*Not included in means.

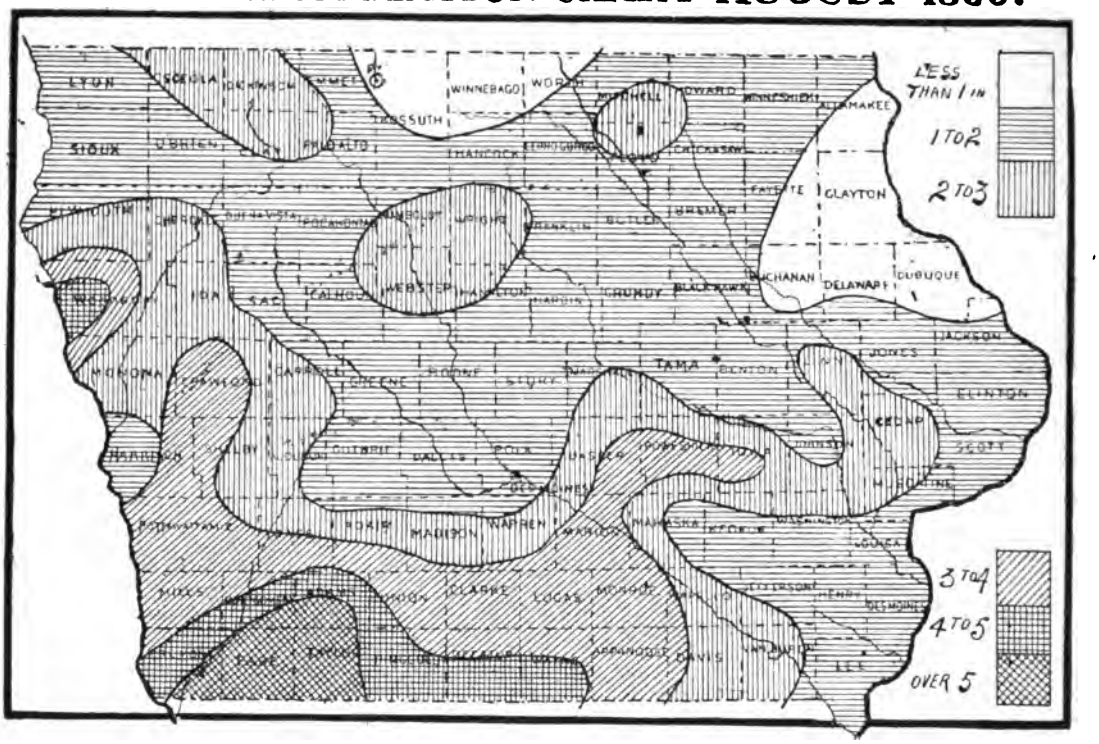
STATIONS.	DATE.																															Monthly Mean.
	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	31st.	
Algona	72	73	73	76	71	71	74	80	81	70	61	63	66	71	70	65	68	66	70	73	71	67	75	61	65	73	67	53	56	59	62	68.5
Alta	72	72	71	74	73	70	76	81	80	74	60	63	68	67	69	68	68	68	68	71	74	70	73	62	62	70	63	56	56	60	65	68.5
Ames (W. R. Cooper)	67	70	70	74	75	73	72	78	79	80	65	62	66	63	70	74	66	68	68	67	71	70	74	64	66	64	65	64	56	61	61	68.0
Ames (4 miles sw of)	76	78	78	80	80	79	80	80	82	77	73	71	72	72	68	74	72	70	70	70	70	74	76	68	67	68	69	69	61	64	67	72.5
Amana	68	73	72	73	76	71	70	76	81	82	69	64	66	68	73	72	68	69	66	67	69	73	76	72	66	66	69	58	57	98	62	69.4
Audubon	64	72	72	75	73	73	72	75	83	74	77	76	72	71	69	72	74	70	68	70	74	70	69	73	74	75	73	69	63	60	62	71.4
Belle Plaine	70	72	71	72	78	71	69	79	82	82	68	64	68	70	72	72	68	64	66	68	70	72	76	72	64	66	69	57	56	58	62	68.2
Blakeville	73	77	79	79	77	70	75	76	76	73	68	66	68	72	71	78	76	76	72	73	71	68	74	75	70	69	66	60	64	70	69	72.1
Bonaparte	72	73	74	76	78	74	74	80	82	84	72	66	70	72	74	76	76	71	67	69	70	73	76	74	68	71	66	60	60	62	66	71.6
Carroll	70	70	70	75	74	72	80	81	79	75	65	58	65	65	69	72	68	66	69	70	72	71	69	73	65	58	69	63	64	55	55	69	68.5
Cedar Falls	70	73	72	74	74	75	72	77	77	82	68	65	66	69	72	75	68	68	70	68	67	72	76	74	69	67	67	58	60	60	68	70.0
Cedar Rapids	70	73	74	74	79	70	69	76	81	82	72	65	65	64	74	74	69	70	66	68	69	74	78	75	67	70	68	60	58	59	62	70.2
Centerville	74	76	74	76	77	77	75	83	85	70	72	73	72	74	71	73	73	72	73	72	74	73	76	74	74	76	74	62	62	61	65	73.0
Charles City	68	70	72	75	74	73	67	80	82	76	66	62	66	68	75	77	70	66	67	70	70	72	75	70	66	67	68	59	51	53	57	68.5
Clarinda	70	71	69	72	76	73	78	82	80	74	67	62	68	72	71	70	68	70	71	71	74	70	74	70	62	67	66	60	59	58	61	69.6
Clinton	70	74	74	74	76	70	68	74	76	80	72	66	68	82	72	75	70	69	66	66	68	75	76	79	68	74	70	62	63	60	64	70.5
College Springs	68	68	70	73	74	74	78	78	80	75	65	64	66	65	62	64	65	68	69	68	66	68	69	70	68	63	66	60	59	60	64	68 0
Corning	66	68	66	71	74	71	76	80	78	72	64	62	64	68	69	70	65	67	69	70	72	68	73	70	60	68	68	58	55	57	60	67.7
Cresco	66	70	71	74	74	66	68	76	80	74	64	62	64	66	73	68	66	65	64	69	66	72	74	68	66	67	65	54	54	59	64	67.4
Davenport	72	76	78	77	81	70	70	77	81	82	73	66	67	71	74	74	72	71	68	69	72	76	76	74	70	74	72	61	60	65	66	72.0
Delaware	66	73	73	72	72	64	63	73	78	74	66	68	64	66	70	69	71	66	63	64	62	71	75	70	65	62	65	59	54	58	60	66.9
Des Moines	68	72	72	74	78	74	76	80	80	76	69	63	68	70	72	73	68	70	68	70	72	74	74	70	64	69	69	56	58	60	64	70.0
Des Moines (5½ miles sw of)	66	70	70	73	76	72	74	80	80	80	66	60	69	70	69	72	68	69	66	69	70	72	74	70	64	67	69	57	56	58	62	69.0
Dubuque	71	74	76	76	79	68	68	76	80	84	71	65	66	68	72	74	70	66	66	71	76	78	74	70	67	72	72	60	61	61	64	70.8
Eagle Grove	68	71	70	71	73	70	70	78	79	72	60	62	61	63	70	69	66	64	65	72	70	65	70	61	58	67	62	52	50	58	58	66.0
Elkader	69	70	72	72	78	68	66	74	79	82	65	60	62	64	70	72	66	64	64	66	66	70	76	71	62	66	65	54	55	56	64	67.4
Emmetsburg	70	73	74	76	71	70	74	80	80	73	60	62	68	66	68	67	70	67	70	70	71	71	70	69	62	69	69	56	57	61	62	68.6
Estherville	75	77	76							68	60	58	64	61	63	70	69	66	68	70	74	71	74	64	57	68	60	54	54	60	64	65.8
Ft. Madison	76	73	78	78	80	79	75	84	85	82	73	70	72	74	71	76	72	73	68	69	72	76	75	74	70	76	76	65	64	70	70	74.3
Fulton									82	72	68	68	69	70	72	70	70	66	66	66	70	76	76	72	67	68	70	62	58	60	64	68.9
Galva	68	72	71	74	70	70	77	81	80	74	58	71	73	66	70	68	67	70	72	74	70	74	62	58	70	64	54	55	54	61	68	68.3
Glenwood							84		84	79	72	66	72	75	79	74	78	76	72	74		71	77	74		82	71	62	60	61	70	73.6
Grand Meadow	68	70	72	74	68	63	68	78	81	74	64	64	50	65	70	67	68	64	64	66	64	68	73	69	66	67	62	56	56	60	65	66.8
Greenfield	70	72	71	77	76	77	80	83	80	79	65	62	67	70	74	70	69	70	69	72	71	72	74	69	62	69	65	55	56	60	70	70.0
Grundy Center	70	72	72	74	73	68	74	78	82	74	61	65	64	70	73	68	70	66	68	71	67	73	73	64	62	69	60	52	56	60	66	68.2
Hampton	70	73	74	75	73	70	69	78	80	78	63	60	66	66	74	70	70	67	68	69	72	74	68	68	62	66	64	53	54	60	64	68 3
Hopeville	69	72	72	75	77	74	77	80	80	78	68	63	69	69	69	72	68	70	69	70	72	70	74	70	65	69	67	58	57	62	66	70.0
Hopkinton	72	75	74	72	76	70	68	80	82	76	67	66	68	72	72	73	71	68	70	71					73	76	73	68	72	59	59	66	68	71.0
Humboldt																																
Independence	71	72	72	66														72	71	68		66	67	73	76	72	66	69	68	58	56	62	66	67.9
Iowa City	71	72	72	73	72	70	71	77	80	82	73	62	65	68	72	74	69	68	65	69	68	74	74	75	70	70	70	66	60	63	64	70 0
Iowa Falls	68	70	70	72	70	71	80	79	79	77	62	60	67	66	74	69	67	64	68	68	70	74	74	68	62	66	63	52	54	58	61	67.8
Jefferson	69	71	71	74	76	72	74	78	76	77	71	61	68	70	74	67	72	69	69	70	72	72	74	64	64	63	60	54	58	61	63	69.2
Knoxville	71	73	73	76	75	74	74	81	81	80	68	64	68	69	72	72	69	69	68	68	70	72	75	72	64	68	70	60	58	60	63	70.3
Keokuk	72	72	75	78	79	73	73	78	80	80	72	67	70	72	70	76	72	74	70	70	71	74	76	74	70	74	74	62	60	65	68	72.0
Keosauqua	72	72	74	77	78	76	76	80	80	82	72	66	74	71	72	74	71	68	70	70	68	77	78	76	69	72	74	60	60	62	66	72.2
La Crosse (Wis)	70	72	74	76	76	67	68	74	84	79	68	64	64	68	72	72	72	68	64	68	71	75	76	73	68	67	70	60	56	60	65	70.0
Larrabee	72	72	72	76	70	74	78	82	81	72	60	64	68	68	70	67	68	69	69	72	70	70	74	61	60	70	62	54	54	60	63	68.5
Logan	70	72	70	74	74	72	76	81	80	80	66	62	70	70	72	70	70	68	70	73	75	70	72	66	63	70	70	64	55	59	62	70.0
Maquoketa	72	72	75	73	72	67	67	74	73	78	66	66	66	66	70	71	64	66	65	66	68	73	76	75	74	73	73	68	60	60	60	69.3
Marshalltown	72	72	70	72	76	71	74	78	80	80	66	62	65	68	74	72	67	70	66	67	70	72	72	72	68	65	72	68	55	59	66	69.7
Mason City	66	70	70	73	71	68	74	77	76	72	60	64	65	66	70	68	65	62	69	69	71	73	72	67	59	61	65	58	52	56	62	67.0
Maxon	74	73	76	80	76	76	78	82	84	74	64	67	68	74	67	69	72	69	68	72	70	72	76	71	64	75	66	59	63	64	68	71.6
Mechanicsville	70	69	75	76	76	66	64	71	76	78	68	62	66	64	70	72	68	62	64	65	69	71	78	73	64	68	69	56	55	56	60	68.2
Monticello	69	72	72	72	78	68	64	73	78	82	68	61	64	66	72	72	68	68	64	65	69	71	78	73	64	68	69	56	55	56	60	68.2
Mt. Ayr	73	72	70	75	79	78	78	82	80	76	71	66	71	72	70	71	73	73	72	71	72	70	74	74	69	74	69	64	59	64	72	72.0
Newton	70	72	71	73	76	72	72	80	80	80	66	68	68	72	72	68	69	66	68	69	72	76	71	64	68	66	69	59	60	62	70	70 0
Omaha	71	72	72	76	78	76	81	83	82	78	70	64	72	72	71	71	70	72	70	74	76	68	76	70	66	72	66	62	59	60	64	71.0
Osage	66	70	70	72	69	67	66	76	78	71	59	58	62	66	67	68	60	61	64	68	67	65	70	62	59	62	60	56	50	57	57	64.4
Oskaloosa	70	72	70	74	77	74	74	83	84	81	69	64	70	71	71	71	66	68	66	68	70	74	76	73	64	67	69	58	57	60	63	70.1
Ovid	71	72	71	74	80	75	76	80	81	81	72	65	70	70	68	73	68	70	68	69	72	74	64	74	64	62	71	67	58	56	59	63	68.4
Panama	69	72	72	74	74	74	80	81	72	74	65	62	70	68	62	72	69	69	68	72	74	64	74	64	62	71	67	58	56	59	63	68.4
Richland	70	69	74	72	78	72	75	78	81	78	66	68	68	71	68	67	70	68	66	68	68	75	74	71	66	72	72	60	52	65	66	70.1
Rock Rapids	70	73	71	72	73	76	78	80	78	63	59	68	68	69	67	66	70	72	72	76	78	68	73	76	68	68	69	52	56	58	56	68.2
Seymour	70	71	72	80	78	75	75	78	83	81	69	64	65	70	70	72	69	70	70	67	72	72	76	69	64	69	62	56	57	61	65	70.2
Sibley	68	70	67	72	67	67	70	77	72	72	58	60	64	66	67	64	70	67	68	70	72	70	72	67	68	68	60	54	52	55	66	66.4
Sioux City	70	74	74	78	73	74	81	83	82	76	64	63	70	66	72	70	71	72	70	75	74	68	74	64	63	72			57	58	61	70.7
Storm Lake	72	78	76	79	74	78	80	82	82	76	64	66	70	68	70	68	71	69	70	72	75	71	76	68	64	72	68	56	59	64	67	71.0
Villisca	70	72	73	73	78	78	78	80	83	82	80	70	64	70	72	72	78	70	76	72	72	70	74	64	60	67	60	66	53	58	58	70.1
Vinton	71	72	72	75	75	69	71	80	81	75	70	66	64	70	72	70	68	66	66	69	70	73	75	67	66	68	66	56	57	58	64	69.1
Washington	76	78	80	80	82	76	76	83	87	80	72	72	71	74	77	74	74	74	70	71	72	77	78	77	72	75	71	64	60	65	68	74 4
Webster City	74	73	72	74	74	74	76	79	76	72	63	64	63	68	72	71	70	70	72	70	69	70	76	64	62	65	62	55	54	58	64	68.7
West Bend	70	72	74	76	70	68	72	78	80	69	59	62	64	67	67	65	67	64	70	70	72	66	76	59	60	73	61	50	55	58	60	67.0
Williams	69	71	70	74	71	68	72	78	78	69	60	62	64	67	69	64	68	65	68	68	68	70	74	64	61	68						68.4
Wintersett	71	72	72	75	78	74	77	84	82	81	70	74	70	70	71	72	70	71	70	70	72	72	75	71	64	69	63	55	57	61	64	70.8

STATIONS.	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th	27th.	28th.	29th.	30th.	31st.	Total.
Algona									T	0.30					T							0.10									0.40
Alta				0.02					T	0.58				0.27	0.07				0.27	0.26		0.16	0.05			0.05						1.93
Ames (W. R. Cooper)										0.96											0.31	0.22		0.11								1.62
Ames (E. N. Eaton)										0.84				0.11	0.20						0.34	0.22	0.13								1.84
Ames (4 miles southwest of)											0.35				0.15	0.20						0.20	0.10	0.08							1.08
Amana					0.32					T	0.15					2.48					0.04	T	0.03								3.02
Audubon										0.13					0.66				0.51			0.18	0.35			0.15						1.96
Belle Plaine										0.52					1 33						0.04	0.07		0.03								1.99
Blakeville										1.00											0.12	T										1.12
Bonaparte										1.17					0.85											0.42						2.92
Carroll										0.18	0.04			0.40	0 68				0.50			0.18										1.00
Cedar Falls										0.50					0.13						0.03	0.13	0.52								0.30	1.09
Cedar Rapids					0.21					T	0.08				T	2.17							0.01									2.47
Centerville										0.70					2.50																	3.20
Charles City										0.55					0.03						0.49	0.13										1.20
Clarinda										0.42					5.60							0.06	0.02		0.12							6.22
Clinton										0.65						0.55																1.20
College Springs										0.36					3.10							0.08										3.54
Corning											3.41				2.75								T				T					6.16
Council Bluffs		1.08		1.66									0.21		0.68			0.11								0.26	0.56					4.56
Cresco				0.01						0 56					0.16						0.30	0.06		0.11								1.20
Davenport										0.08	0.70				0.01	0.33							T									1.12
Delaware					0.04					0.27					0.20	0.41					0.12			0.02								1.06
Denison										0.65					1.32				0.90			0.11					0.23	0.49				3.79
Des Moines								T		0.62	0.01			T	0.19	0.49			T		0.15	0.01	0.11	0.02								1.60
Des Moines (5½ miles southwest of)										0.36				T	0.90						0.15	0.08										1.49
Dubuque										0.10	0.02					0.46																0.58
Eagle Grove										0.25				0.15	1.10						1.00	0.40	0.10	T								3.00
Elkader										0.28						0.35					0.20											0.83
Emmetsburg									0.72					0.46						0.90	0.28											2.36
Estherville								0.02		0.67							0.15				0.56	0.37					0.02					1.79
Ft. Madison	T									0 86						1.02											T					1.88
Fulton										0.70						1.05																1.75
Galva										0.66				0 28	0.03				0.65	0.42		0.88	0.56			0.18						2.96
Glenwood										1.01					1.75	0.49			0.32					0.05			0.23					3.88
Grand Meadow					T					0.89					T	0.13					0.65		T									1.70
Greenfield										1.04				0.50	1.06	0.01			0.03			0.09					0 19					2.92
Grundy Center								0.02		1.13				T	0.13					0.18	0.01	0.09										1.56
Hampton										0.36					0.07	0.06					0.36	0 30										1.15
Hopeville								0.02		0 94	0.02			0.12	2.27							0.01					0.02					3.40
Hopkinton				T	T					0.25						1.00			T						T							1.25
Humboldt								0 01		0.50				0.01	0.54						0.72	0.32	0.02			0.01						2.13
Independence										0.40					0.35						T	T										0.75
Iowa City					T					6.06			T			1.58																1.64
Iowa Falls										0.65											0.13	0.15		0.02								0.95
Jefferson								T	T	0.30	0.50				0.38	0.19			0.22		T	0.01	0.08				0.08					1.76
Knoxville								T		1.00					2.26						0.07	0.04										3.41
Keokuk					T					0.18	0.32				0.14	0.52							T									1.16
Keosauqua					T					0.20	0.91	T			0.25	0.90							T									2.26
La Crosse (Wis.)					T					0.34					0.48	0.32							0.04	0.12	T							1.30
Logan										0.23				0 70	0.36				0.49								0.21					1.99
Larrabee										1.07				0.14	T			0.27		T		0.37	0.01			0.32						2.18
Maquoketa					0.05					0.35						1.22																1.62
Marshalltown										1.79					0.51							0.13										2.43
Mason City				0.30						0.44					0.59		0.25						0.25									1.83
Maxon					T			T		1.00				T	1.52				T		T		0.90									3.42
Mechanicsville					1.35					0.15					0.80	0.60																2.90
Monticello					T					0.06				T	1.17						T	T	T									1.23
Mt. Ayr									1.10	0.20			0.28	2 26								0.14										3 98
Murray								1.58		0.46					T	3.65			T		T		0.02				0.02					5.73
Newton										1.38						0.05	1.30				0.10	0.30	T	0.02								3.35
Omaha (Neb.)					T					0.22			T	1.17	1.35		0.02		0.27			0.02	T				0.57					3.62
Osage				T					0.81					T	1.14		0.05				0.40	0.17										2.57
Oskaloosa					0.10					0.35						1.18					T	0.50										1.69
Ovid								0.02		1.28				0.16	0.66	1.26			T			0.13					0 02					3.53
Panama										0.35					1.01						0.45	0.06	0.16			0.29						2.32
Richland					0.01					0.55					1.23						T		0.12									1.91
Rock Rapids									0.30	T								0.23	0.04	0.20		0.45	0.02			T						1.24
Sac city										0.50				0.75					0.30							0.50						2.05
Seymour										1.18				1.53	1.83			0.13														4.67
Sibley				0.33						0.75								T		0.63					0.26			0 19				2.26
Sioux City				T	0.24					0.06				0.14	T		0.06		0.90	0.03	0.96	0.13	2.08			0.50	0.75				T		5.85
Storm Lake										0.50				0.28	0.36				0.23	0.07		0.26	0 14			0.06							1.90
Villisca										2.32					1.32	2.55						0.07	0.08				0.03						6.32
Vinton										0 14					1.26																		1.40
Washington											0.55					1.10																	1.65
Webster City										0.75					0.50						0.80	0.25	0.60										2.00
West Bend				T						1.42				0.01	0.09						1.20	14											

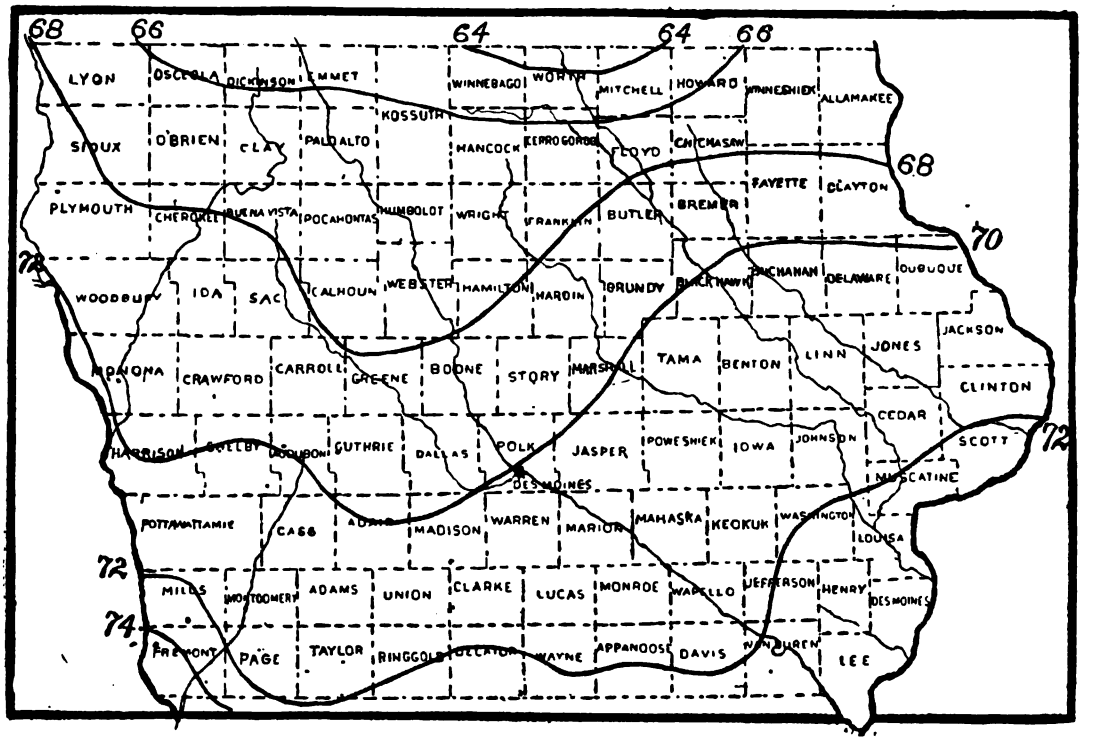
MAXIMUM AND MINIMUM TEMPERATURE FOR AUGUST, 1893.

| STATIONS. | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | | 9 | | 10 | | 11 | | 12 | | 13 | | 14 | | 15 | | 16 | | 17 | | 18 | | 19 | | 20 | | 21 | | 22 | | 23 | | 24 | | 25 | | 26 | | 27 | | 28 | | 29 | | 30 | | 31 | | Monthly Mean. | |
|---|---|---

IOWA PRECIPITATION CHART AUGUST 1893.



MEAN TEMPERATURE AUGUST 1893.



METEOROLOGICAL STATIONS AND OBSERVERS.

From the following, weekly and monthly reports of Meteorological data are received by the Iowa Weather and Crop Service.

Albia	Gus Johnson.
Algona	C. D. Pettibone.
Alta	D. E. Hadden.
Amana	Conrad Schadt.
Ames	E. C. Dickinson.
Ames	W. H. Heileman.
Ames, (4 miles S. W.)	Isaac Young
Atlantic	J. W. Love.
Audubon	J. F. Hocker.
Belle Plaine	H. W. Vandike.
Blakeville	James Rodgers.
Blockton	C. W. Thompson.
Bonaparte	Hon. B. R. Vale.
Carroll	Moses Simon.
Cedar Falls	Prof. A. C. Page.
Cedar Rapids	H. D. Olds.
Centerville	Prof. R. E. Reister.
Charles City	J. W. Smith.
Clarinda	A. S. Van Sandt.
Clinton	Luke Roberts.
College Springs	A. A. Berry.
Concord	J. M. Elder.
Corning	John W. Bixby.
Cresco	Gregory Marshall.
Council Bluffs	E. W. Hart.
Davenport	*F. J. Walz.
Delaware	Wm. Ball.
Decorah	L. H. Baker.
Denison	P. H. Schlumberger.
Des Moines	*Geo. M. Chappel, M. D.
Dubuque	*S. C. Emery.
Eagle Grove	C. A. Schaffter.
Eldora	Prof. C. F. Woodward.
Elkader	Chas. Reinecke.
Emmetsburg	H. Conroy.
Estherville	Leroy L. Barnham.
Fairfield	J. Fred Clarke, M. D.
Fayette	R. Z. Latimer.
Ft. Madison	Miss L. A. McCready.
Galva	W. A. Crowley.
Glenwood	Seth Dean.
Greenfield	J. G. Culver.
Grinnell	Prof. S. J. Buck.
Grundy Center	Chas. G. Rogers.
Hampton	E. C. Grenelle.
Hawkeye	J. W. Bopp.
Hopeville	M. T. Ashley.
Hopkinton	Theo. Marks
Humboldt	J. W. Foster.
Independence	E. F. Wulfke.
Indianola	Prof. J. L. Tilton.
Iowa City	Prof. A. L. Arner.
Iowa Falls	J. B. Parmelee.
Jefferson	Dr. Chas. Enfield.
Keokuk	*Fred. Z. Gosewisch.
Keosauqua	Prof. J. H. Landes.
Larrabee	H. B. Strever.
Logan	Mrs. M. B. Stern.
Mason City	H. I. Smith.
Manson	W. L. Thompson.
Marshalltown	L. S. Kilborn.
Maquoketa	Dr. A. B. Bowen.
Mechanicsville	Rev. J. W. Hubbard.
Milton	Hon. E. C. Holland.
Mooar	F. G. Thomas
Monticello	Henry D. Smith
Mount Vernon	Prof. A. Collin.
Mt. Ayr.	Hon. Wm. Shriver.
Murray	A. W. Lewis.
Muscatine	J. P. Walton.
Newton	A. Lufkin
Omaha, Neb	*Geo. E. Hunt.
Ovid	H. C. Miller.
Osage	G. D. Pattingill
Oskaloosa	Jos. Boyd.
Panama	Wm. J. Wicks.
Postville	F. L. Williams.
Richland	Wm. A. Shaffer.
Rock Rapids	W. C. Wyckoff.
Seymour	Mrs. C. A. Conger.
Sibley	H. G. Doolittle.
Sidney	G V. Swearingen.
Sioux City	*U. G. Pursell.
Sac City	Dr. C. Brown.
Spirit Lake	W. A. Siddall.
Storm Lake	A. J. Bond.
Tipton	J. M. Rider.
Vinton	T. F. McCune.
Villisca	Hon. J. S. Boise
Washington	Wm. A. Cook.
Webster City	C. M. Trumbauer.
Winterset	Will McKnight.
West Bend	Phil. Dorweiler
Williams	M. L. Fuller.

*U. S. Weather Bureau.

WEATHER-CROP OBSERVERS.

Reporting for the Weekly Bulletin.

Afton	M. V. Ashby.
Agency	J. H. Van Zant.
Albia	Wm. Mercer.
Alta	Hon. H. T. Saberson.
Ames	Henry C. Wallace.
Anita	H. T. Chapin.
Ankeny	Ed. Parmenter.
Battle Creek	A. Preston.
Bloomfield	Geo. Duffield.
Boone	L. C. Morris.
Carbon	N. M. King.
Carson	G. N. Ferguson.
Centerville	Henry Galley.
Charles City	W. B. Towner.
Charlton	C. C. Burr.
Clarksville	F. M. Russell.
Corning	Jerome Smith.
Clermont	Chas. Larrabee.
Council Bluffs	L. Prouty.
Dedham	J. W. Kay
Danville	Sherman Matthews.
Emerson	D. B. Nims.
Ely	Hon. A. J. Fuhrmeister.
Fontanelle	W. H. Bridgman.
Ford	W. W. Whitmore.
Fort Dodge	R. W. Blaine.
Geneva	Wm. H. Thompson.
Gosport	B. F. Banta.
Grand River	Dr. John Daykin.
Grinnell	A. O. Price.
Harlan	Fred Fischer.
Hesper	G. E. Dillingham.
Hodge	James Piper.
Hamlin	F. P. Moore.
Humeston	Hon. S. H. Moore.
Independence	C. L. Thomas.
Indianola	T. B. Hammer.
Jefferson	S. M. Taylor.
Larrabee	H. H. Carnahan.
LeMars	Hon. Henry Schrooten.
Ledyard	Frank Miller.
Lawler	Hon. Wm. Glattly.
Lockridge	John F. Farman.
Manning	H. W. Pollock.
Mapleton	A. Lamb.
Marshalltown	Hon. J. G. Brown.
Mason City	Wm. Nettleton.
Mt. Pleasant	W. S. Wright.
Minburn	J. W. O'Brien.
Mount Vernon	Robert Smith.
Newton	J. P. Beatty
North English	J. L. Williams.
Nevada	O. G. Ashford.
Osage	E. W. Stacy.
Orange City	H. J. VandeWaa.
Paton	Hon. Joshua Jester.
Pittsburg	G. C. Duffield.
Polo Station	A. E. Miller.
Prescott	G. W. Iden
Paullina	Geo. Hakeman.
Rockwell City	J. G. Palmer.
Rock Rapids	D. E. F. Merrill.
Rossville	F. B. Wiley
Sandusky	Z. Hollingsworth
Sageville	Hon. F. N. Knoll.
Shenandoah	Reuben Mullison.
State Center	E. N. Thompson.
Sumner	John Dawson.
Tama	W. G. Malin.
Van Horn	Spencer Smith.
Wapello	O. P. Smith.
Waukee	John Wragg
Wheatland	D. Beckman.
Willow Creek	W. S. Nicholson.
Winterset	H A. Kinsman.
Wall Lake	T. E. Wilcox.
Walnut	F. L. Martin.
What Cheer	O. D. Lawrence.

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MONTHLY REVIEW

OF THE

J. R. Sage,
Des Moines.

Iowa Weather and Crop Service.

VOL. IV.—SEPTEMBER, 1893.—NO. 9.

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CENTRAL STATION, DES MOINES, IOWA.

J. R. SAGE,
DIRECTOR.

GEO. M. CHAPPEL, M. D.,
LOCAL FORECAST OFFICIAL,
U. S. WEATHER BUREAU, ASS'T DIRECTOR.

DES MOINES:
G. H. RAGSDALE, STATE PRINTER.
1893.

THE IOWA WEATHER AND CROP SERVICE.

Was established by act of the Twenty-Third General Assembly, and placed under supervision of the Board of Directors of the State Agricultural Society, constituted as follows:

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Vice-President—John A. Evans, West Liberty, Muscatine Co.
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J. W. McMullin. John A. Evans, John R. Shaffer.

U. S. Department of Agriculture---Weather Bureau.

MONTHLY REVIEW

OF THE

IOWA WEATHER AND CROP SERVICE.

VOL. IV.] SEPTEMBER, 1893. [No. 9.

IOWA DAY AT THE WORLD'S FAIR.

ADDRESS BY GOV. HORACE BOIES, DELIVERED AT JACKSON PARK, CHICAGO, SEPTEMBER 21, DURING THE CEREMONIES IN HONOR OF IOWA.

Mr. President, Ladies and Gentlemen: I should fail to express the wishes of the people of my State if I did not at this time and in this public way extend to the Iowa Columbian Exposition, and its faithful employes, the gratitude we all feel for the manner in which they have discharged the laborious duties their positions impose.

In behalf of the same people, it is a pleasure to me to publicly express the obligation they are under to the National Commission for its generous treatment of Iowa interests, and for the uniform justice and courtesy of its members, individually and collectively, in all their dealings with the representatives of our State.

I should be false to my own feelings, and to those of my people as well, if I should strive to conceal the pride we feel in the exhibit here presented by our youthful commonwealth, and the proud position it has gained for us in the estimation of those who are permitted to view this, the greatest of the worlds' expositions.

I am justified in speaking of Iowa as a youthful State, for it is scarcely more than a quarter of a century since the era of rapid development began which has crowded her so far toward the front when compared with sister States.

It was not until 1867 that the first trunk line of railway to cross the State reached its western boundary, spanning as it did at that time an almost unbroken wilderness of raw prairie for more than half its length of 355 miles. Now every one of its ninety-nine counties is penetrated by one or more of these great highways that stretch across her plains in every direction until their total length exceeds 8,500 miles, employing in their operation an army of more than 30,000 men, and moving annually, from place to place within her borders, 12,000,000 tons of freight.

She has in round numbers 35,000,000 acres of land, of which 95 per cent is susceptible of the highest degree of cultivation.

Although her annual rainfall is less than most of the Eastern States, it is so distributed that during the spring and summer months it is greater than theirs, assuring thus far in her history never failing and abundant crops.

The sixteenth in number of the States admitted to the Union, Iowa already leads her sisters, both old and young, in the total value of her grain production and her live stock, two of the most important of all the staples produced on the American continent.

For many years she has held her place at the head of the column of States in the production of that greatest of staples of the great northwest—Indian corn—of which, in a single season, she has harvested more than 330,000,000 bushels. In all other products of the farm grown in this latitude in any part of our country her soil has always been most liberal in its returns for the labor of the husbandman.

In 1892 she was second to Illinois only in the number and value of her horses; to New York only in the number and value of her milch cows; to Texas only in the number and value of other cattle, and the first of all the States in the number and value of her swine, and also in the total value of all live stock upon her farms.

The fame of her dairy products is already as wide as the markets of the world. In the year ending September 30, 1892, we shipped to Eastern and foreign markets almost 72,000,000 pounds of butter and consumed at home, as estimated by our Dairy Commissioner, 100,000,000 more.

A few counties in the southern and southwestern part of the State have already become famous as a fruit bearing section, producing as they do apples of the best quality in great abundance, as well as large quantities of other useful fruit. There is, I believe, no part of the State in which sufficient for the wants of our people cannot be produced, but with the exception of the southern and southwestern counties it cannot be said to be a fruit bearing State.

Nor is it in the products of her farms alone that Iowa is rich. She has within her boundaries not less than 10,000 square miles of most valuable coal lands, besides large areas which produce lead, zinc, iron and other valuable minerals.

She has now in operation nearly 500 coal mines that give constant employment to an average of 12,000 men, and produce an annual output of more than 3,000,000 tons, of the value of $5,000,000.

In nearly all her cities manufacturing enterprises of many kinds are permanently established and these are being largely increased as the fact of her boundless supply of cheap fuel for motive power becomes more generally understood.

It is not, however, to her agricultural or mineral wealth, boundless as it is, that Iowans point with greatest pride when speaking of their State, for it is not in these alone that she ranks so high.

Gleaned as our population has been from every State in the Union and almost every country of the globe, she has a less per cent of illiterate persons than any of her sister commonwealths. More than one-fourth of all her inhabitants are enrolled as pupils in her common schools in which an army of 27,000 devoted teachers are employed, and $7,500,000 are annually expended by her people in their support.

She has, too, a State university, an agricultural college, a normal school, a school for the deaf and dumb and a school for the blind—all supported at public expense, and all ranking high among institutions of their class in any part of the world. All

over the State are sectarian colleges of almost every denomination, and non-sectarian schools of a high order, so that every want of those who are in pursuit of an advanced education is easily supplied in her own schools.

Outside of as well as in her school buildings her State institutions have been constructed upon a lavish, if not an extravagant scale.

She has three insane asylums, costing an average of nearly a million dollars each; two penitentiaries, two reform schools, a school for the feeble minded, a home for the adult blind, a soldier's home and an orphans' home—all supported at public expense.

Her annual expenditure of money for the support of all her public institutions is, in round numbers, $2,000,000, or about two-thirds of the entire revenues of the State.

There are few, if any, of the religious denominations known to the western hemisphere that are not represented among her church going people, and all of the principal sects are abundantly supplied with church edifices and liberally supported by her citizens.

Her climate, though cold in winter and warm in summer, varying on rare occasions from thirty degrees below zero in the coldest of winter days to nearly 100 above in the hottest of summer days, is largely tempered by the fact that her atmosphere, as a general rule, is comparatively free from moisture, which adds so much to discomfort on chilly days in much warmer latitudes.

Many of our friends in the East, especially, have formed most exaggerated opinions of the dangers we are in from death-dealing storms. In the whole history of the State three only have been known that are worthy of note. These have often been spoken of as cyclones. This is a misnomer, for cyclones usually cover large areas of the earth's surface, both in length and breadth, the recent one on the Atlantic coast reaching, it is said, 3,000 miles in length and covering a space on land and sea from 300 to 500 miles in width.

The three storms from which Iowa has suffered were tornadoes that appeared in the form of funnel-shaped clouds, with the larger portion upward and reaching almost to a point where they touched the earth. Their destructive force was exerted by a rotary or whirling motion that never, I believe, covered a space to exceed half a mile in width (usually much less) and but a short distance in length. Their tracks, devastated as they were, were mere dots on our great prairies. The storms were not as destructive to life or property as the aggregate casualties of ordinary thunder storms that sweep over most of our states in the same number of years.

It must be remembered, too, that Iowa is no more subject to such storms than many of the other states, and but little, if any, more so than the country east of the Rocky mountains. Those who fear our storms so much should remember that the one cyclone that swept the Atlantic coast a few weeks since caused more destruction to life and property than all the storms known to Iowa since discovery.

For the information of those who are strangers to our State, and whom I have the honor to address, I have tried to portray her advantages and disadvantages with equal truthfulness and without prejudice because of its being my own home.

I want now to speak of Iowa as she appears to her own people and call attention to her present advantages as they see them.

There are still within the State thousands upon thousands of acres of land, richer than the valleys of the Nile and fresh as it came from the hands of the Creator, for it has never felt the plowshare's touch or administered to the wants of the children of men.

Down deep beneath the surface of her great plains and far out under the bluffs of her winding streams are stores of nature's wealth that no man has fathomed; that no man can exhaust.

In her cities and towns are numberless opportunities for the profitable employment of millions upon millions of capital in various kinds of manufacturing enterprises, and in their constantly widening fields of trade.

Everywhere, on every hand, along her crowded railways, in the fields of her great farms, in the lengthening drifts of her mines, in the hum of her busy shops, in her varied forms of undeveloped natural wealth is a never satiated want for the toilers of the world, for men like those whose brawny arms and steady nerves have made her what she is and enabled her each year from field and mine and shop to pour into the great streams of commerce that flow across her plains the tribute of her own productions and help to swell the mighty torrent of trade that has built the city in which we meet, a city that for its years has not now and never had a peer in any age.

From the abundance of her resources such as they represent we have necessarily brought to this Mecca of the world's best treasures but limited specimens of the products of our State, and yet in the glare of this babel of priceless and indescribable things we are proud of our exhibit and proud of the men and women whose deft hands and untiring zeal have made it so conspicuous a feature in such a marvelous show.

For twenty-six years, more than half her existence as an independent commonwealth, Iowa has been my home, and long before I knew her well. I have seen most of her great enterprises grow from infantile proportions to their present proud positions.

From a few short pieces of railways at different points on the eastern border I have witnessed her present magnificent system of more than 8,000 miles of road grow to completion and its operation improved until its present state of usefulness has been attained; and along the lines I have seen cities and towns by hundreds, by thousands, by more than this, spring like magic from these limited years: and out upon her trackless prairies, as I knew them first, I have seen fields of waving grain and pastures filled with grazing herds usurp the places of the wild flowers and timid game of these great meadows, planted by the hand of the Omnipotent and reserved for the use of man in this "best of ages."

With all her magnificent resources for the accumulation of wealth, with social, educational and religious advantages that should satisfy the most exacting, with her busy, bustling throng of 2,000,000 of human beings, Iowa is not yet half peopled. To the good and brave of every land her arms are open, and with all her heart she bids them come.

EDITORIAL NOTES.

During the prevalence of the almost unparalleled drought in August and September, the professional rain-makers, who claim to know the secret of milking moisture from even the most arid skies, seem to have been exceedingly negligent or indifferent. Where were they during those scorching, parching days and weeks? Were they on a strike for higher pay, or were they idle because no one offered them hire? If they were at work, was there something wrong with the cranks of their machines, or the chemicals used in the operation? What's the matter, any way? In these latter days of science and progress it's a shame to allow things to be burned up for the want of a few ounces of chemicals and a crank to grind them. We are afraid, however, that our science of rain-making, as well as all signs of rain, fails in a drought. And the rain-makers wisely retired from public sight when the drought was so tenaciously holding its grip. The best time for making rain is during the prevalence of a wet spell. It will almost make itself in such seasons.

***

The Secretary of State of Michigan, in his report of September 1st, says the drought then prevailing in Michigan was without a parallel. There was no general rain

for a period of over seventy days, and only temporary relief was afforded by light local showers. The drought was quite general throughout the West, and also in portions of the Eastern States. Iowa suffered least of all the Northwestern States.

***

The buckwheat crop of Western Russia was cut down by a frost early in July. Potatoes were also severely frost-bitten.

***

According to the report of engineers of the hydrographic office the Gulf of Mexico is one foot higher than it was in 1859. That proves that the earth is not slowly drying up, as some alarmists tell us. In fact, it seems to indicate that we are in more danger of being drowned out, for if the same ratio of aqueous increase is steadily maintained the whole of Iowa will be under water within a period of 52,000 years. But there is no occasion for alarm, or for the building of arks, for most likely the general level of the Gulf will not be materially changed within the next million of years or so.

***

The hay crop of the United States is worth $100,000,000 more than the cotton crop. Grass is king.

The Meteorological Council of Great Britain announces with pride that 84 per cent of her weather forecasts were verified last year, and that 93 per cent of the storm warnings were successful.

***

H. J. Patterson, of the Maryland Experiment station, has been conducting feeding experiments which show that all parts of the corn plant contain valuable food materials. The corn stalks and husks contain 60 per cent of the total digestible matter produced by the plant, the blades 11 per cent and the ears 29 per cent. The corn fodder from one acre yielded as much digestible matter as two tons of timothy hay, and more food than was contained in the corn ears from the same acre. Of pure digestible matter the husks contain 72 per cent, the stalks 66 per cent, the blades 64 per cent and the topped stover 55 per cent. Evidently the farmers of Iowa have never appreciated the value of corn fodder.

***

Deep-sea soundings off the coast of Alaska reached a depth of 4,500 fathoms—the greatest depth ever reached by a sounding line.

***

Beyond 29,000 feet above sea level, the height reached by Glaisher in 1862, man has never been able to navigate the air. Various problems concerning the region farther away—such as temperature, the pressure, the quantity of moisture, the composition of the air, etc.,—have attracted the attention of physicists and have at last led to the experiments of M. Hermite, who, during the last few months, has been sending up pilot balloons carrying registering apparatus. These balloons are very light, with a capacity of about 100 to 200 cubic feet. Falling at a distance from Paris ranging up to 200 miles the balloons have nearly all been returned by their finders, as requested on a card attached to each, and one has brought down records from a height of 30,000 feet. The instruments used are very light and simple. With larger balloons and systematic exploration, it is hoped that the secrets of the air up to at least 40,000 feet may be made as familiar to us as those of the deepest and darkest depths of the sea are gradually becoming.—*Scientific American.*

***

In respect to area covered and extent of devastation, our western tornadoes are mere scratches compared with the cyclones which occasionally sweep the Eastern and Southern States with a besom of destruction.

***

Referring to the value of trees as a protection against tornadoes, Prof. J. L. Budd, in *Rural Life* says: "A number of years ago the writer followed the line of the Camanche tornado many miles. In every case noted it was lifted up in passing groves and tree belts, and often did not dip to the earth until a mile or more of the prairie had been traversed. Again, the track of the great Minnesota tornado of a few years ago was followed by a party of the horticultural society. The report was made that without exception, the storm was lifted up by belts and groves of trees."

***

There is one fact that has never been duly considered in discussions relative to wheat production and the future of that staple. The people of this country are diversifying their diet, as well as their crops. There is not nearly so large consumption *per capita* as there was fifteen, twenty or thirty years ago. The Americans are the most liberal feeders in the world, and bread is no longer the staff of life. We make larger use of meats, eggs, vegetables, oatmeal, rice, cornmeal, hominy, beans, and all kinds of fruit, than in former years. This is measurably true of the people of limited means, as well as the wealthy classes. Bread would be scarcely missed if it were entirely left out of the bill of fare of the average American family. The consumption of fruit is steadily on the increase, while the wheaten loaf is becoming a less important factor in our daily living. In view of this fact, should not our statisticians lower their estimates of the amount of wheat *per capita* required for home consumption?

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Analysis shows that white corn has about one per cent more of the muscle-forming elements than yellow corn, and it is therefore better food for working animals, including man himself.

***

In establishing the geological survey of Iowa two years ago, the General Assembly provided for investigations of "the character of the various soils and their capabilities for agricultural purposes." In compliance with the law the survey has already begun a systematic study of the

soils of the State and has made preparation for a thorough investigation of the subject. In connection with members of the Agricultural College the geological survey proposes to pay particular attention to the Iowa soils with the view of preparing an accurate soil map of the State. It will have the co-operation of Prof. Milton Whitney, who has become so eminent in his researches in soil physics; Prof. G. E. Patrick, of the Agricultural College, who has already done much valuable work in connection with soil analyses. With the adaptabilities of the soils always in view, Prof. L. H. Pammel and Prof. T. H. McBride and others have offered their services in studying the plants. Members of some of the agricultural and horticultural societies have expressed a desire to co-operate, and most of the organizations in the State will probably unite in the work. An article in this issue on "Iowa Soils in the Light of Recent Investigations," by Prof. Henry Foster Bain, will repay a careful perusal.

***

On October 1st and 2d a cyclone of West India origin, coming in from the Gulf of Mexico, wrought fearful destruction of life and property along the coast from New Orleans to Pensacola. The estimated loss of life is about 2,500, and the total destruction of property is believed to exceed $5,000,000. With singular perversity in the misuse of names some of the western papers have termed that great storm a "tornado."

***

The aggregate loss of life and property by cyclones in the Atlantic and Gulf States, within the past two months, vastly exceeds the total losses by all classes of windstorms in the northwestern states since their settlement by civilized man. And yet a great deal of sympathy has been expended upon the people of the storm-swept west.

***

The city council of Ottumwa has authorized the purchase of instruments and flags for the establishment of a meteorological and display station of the first class, with Dr. L. J. Baker, physician of the board of health, as observer and displayman. He has generously offered to make monthly reports to the State Weather Service. We look for good results from that station. Every important city should take measures to secure reliable meteorological records.

***

Colman's *Rural World* says: "One of the most interesting things to know just now is how the corn is going to turn out. Some good practice might be had by going into a field and measuring out one rod square of the ground and counting the full ears, leaving out the nubbins as a make-weight. Each 100 good-sized ears may be taken for a bushel of corn shelled. If there are twenty-five good ears on the square rod the yield will be forty bushels to the acre. If there are fifty, the yield will be eighty bushels.

***

A stalk of Mahaska corn, on exhibition at Oskaloosa, measures 17 feet from roots to tassel, and bears two big ears at a height of 12 feet above ground. That stalk brings down the persimmons. Can any other county overtop it? The old fiction about husking corn by the aid of a step ladder, or from the top of a wagon box, would become a verity if that style of corn stalk should come into fashion.

***

The Chicago *Tribune*, in estimating the amount of wheat required for home consumption, says the people of the United States consume, in round numbers, one million bushels of wheat every day in the year. That implies an average daily consumption of about 10 ounces of wheat flour, in the form of bread, pastry, etc., for each person, old and young. We think the figures are too high, and that the annual consumption of wheat in this country is generally over-estimated. The Statistician of the Department of Agriculture places the average annual consumption at 4¼ bushels per capita. That is more nearly correct than the *Tribune's* estimate, but it implies an average daily consumption of 8 ounces of wheat flour per capita, and we are certain that is somewhat above the mark. American people are omnivorous in their dietary habits.

IOWA CROPS AND LIVE STOCK.

BIENNIAL CENSUS OF CROPS AND LIVE STOCK, MADE BY TOWNSHIP ASSESSORS.

The law of the Twenty-fourth General Assembly, requiring assessors to make biennial returns of the acreage and yield of staple crops, and the number of live stock, etc., has produced quite satisfactory results, considering the fact that this system of gathering agricultural statistics is new in Iowa.

The returns of the assessors, for the current year, showing the acreage and yield of crops in 1892, and the number of live stock owned by the farmers of Iowa, in January, 1893, have been carefully tabulated and the footings give us the basis of an approximately correct estimate of the farm products of the present year. We give herewith some of the figures relating to the more important products of the State.

LAND IN FARMS—The returns show the number of acres of land in farms to be as follows: Improved, 25,024,117; unimproved, 5,186,377; total, 30,210,494 acres. These figures are evidently correct as to the acreage of farms in this State. The State census in 1885 gave the following figures: Improved land, 20 189,894 acres; unimproved land, 8,058,853 acres. The acreage of land in pastures in 1885 was 5,265,858 acres; acreage in 1893, 7,812,898. These figures include only improved or fenced pastures.

WHEAT—The acreage of winter wheat sown in the fall of 1892, (harvested in '93) amounted to 233,553 acres. Spring wheat harvested in 1892, 660,240 acres. There was a decrease of 6 per cent in the acreage of spring wheat this year, compared with 1892. The estimated acreage of wheat (winter and spring) harvested this year is, therefore, 854,189 acres. The census of 1885 returned the acreage of spring wheat (in 1884) at 1,294,722 acres; winter wheat, 56,824 acres; a total of 1,251,546 acres. This shows a nota-

ble decline in the acreage of spring wheat, and a moderate increase in the winter.

CORN—Making due allowance for a number of towns from which returns were not complete, the land in corn in 1892 was 5,469,946 acres. According to the estimates of the correspondents of this bureau, there was an average increase this year of 10 per cent, compared with the crop of 1892. The area planted this year was, therefore, 6,016,940 acres. That is believed to be approximately correct. It certainly is not an underestimate. In 1884 Iowa's corn acreage was 6,558,724 acres.

OATS—The area in oats in 1892 was 3,997,737 acres. An estimated increase of 5 per cent, compared with last year, would make this season's acreage 4,197,623. The acreage in 1884 was 3,054,127.

BARLEY—Acreage of barley last year, 501,081. The estimate for this year is 506,091 acres.

RYE—Acreage last year, 117,771. This season's acreage, 109,528.

BUCKWHEAT—Last year's acreage, 31,042 acres. No change in estimate this year.

FLAX—Last year's acreage, 282,700. Estimated acreage this year, 248,776.

TIMOTHY SEED—Acreage last year, 164,104, with an average yield of 4⅘ bushels per acre. No change in estimate for the present season.

CLOVER SEED—Acreage, 54,538; yield 1⅘ bushels per acre.

IRISH POTATOES—Number of acres reported last year, 109,733. Estimate this year, 104,261 acres. This does not include the small patches raised in gardens, which would make a considerable showing in the aggregate yield.

TIMOTHY—The timothy cut in 1892 was 2,458,015 acres. Acreage about the same this year.

CLOVER—The clover cut last year was 258,373 acres; average yield 1⅘ tons per acre.

PRAIRIE HAY—Cut last year, 1,999,403 acres; average 1¼ tons per acre,

MISCELLANEOUS—Millet, 176 800 acres. Hungarian grass, 9,971 acres. Artificial groves, 178,947 acres. Orchards, 111,488 acres. Vineyards, 3,691 acres.

HORSES—Number of horses January—Common or grade, 1,281,544; thoroughbreds, 5,269; total, 1,286,813. Number of mules, 32,015.

CATTLE—Common or grade, 3,399,810; thoroughbreds, 21,573; total 3,421,383.

SWINE—Number in January, 3,443,118.

SHEEP—Common or grade, 561,356; thoroughbreds, 7,065; total, 568,421.

STANDS OF BEES—Native, 126,403; Italian, 37,664; total 164,067. Pounds of honey produced last year, 2,142,555.

IOWA'S CORN ACREAGE.

In the weekly Weather Crop Bulletin issued from this office September 19th, the following statement was made:

"The area planted in corn in Iowa this year, is about six million acres. All estimates based on a greater acreage are unreliable."

This statement seems to have caused some discussion and criticism in commercial circles, and resulted in the following correspondence, which is self-explanatory.

CHICAGO, Sept. 21, 1892.

Mr. J. R. Sage, Director, etc., Des Moines, Iowa.

DEAR SIR: In the press synopsis of your report of September 19th it is stated that the area planted in corn in Iowa this year is about six million acres, and that any higher estimate is unreliable.

I desire to know whether you have been correctly quoted, and if so, upon what authority you base this estimate. In 1889 the census returns more than 7,500,000 acres in corn, and I am loth to believe that the acreage has shortened twenty per cent in three years, especially as some corn this year was planted in land originally intended for wheat.

Yours respectfully,

B. W. SNOW.

REPLY.

DES MOINES, Sept. 22, 1892.

MR. B. W. SNOW, *Chicago, Ill.*—DEAR SIR: Replying to your favor of the 21st, I would state that the crop bulletin issued by this bureau on the 19th instant was correctly quoted in the press synopsis. The authority for my estimate was given in the same dispatch, viz: the tabulated reports of township assessors, made under the provisions of an act passed by the Twenty-fourth General Assembly (1892). The law makes it the duty of all assessors to make a complete census of crop acreage, yield, etc., of the previous year, not for the purpose of taxation, but to be used by this bureau as a basis of crop reports and estimates.

The assessors, being carefully instructed and supplied with blanks, entered upon this work with zeal and fidelity, and as a result we have a very complete census of the acreage, soil products and live stock of this State for the year 1892. Using that as a basis, and making allowance for an increase of 10 per cent, as compared with 1892, we have this year a corn area of about 6,000,000 acres. This would indicate that about one-fourth of the improved farmed lands of this State are in corn. The government estimate of corn acreage has been too high. In 1891 this State was credited with 9,500,000 acres in corn, involving the absurd conclusion that 38 per cent of our farmed lands were devoted to that single crop. This year the government gives us 7,500,000 acres—a reduction of over 21 per cent in two years.

We have abundant corroborative proof of the reliability of the late census made by the Iowa assessors. The State census of 1885 showed our corn acreage to have been 6,558,724. It is well known that the area in corn reached ts highest point in the 80's, and that in recent years there has been a marked tendency toward dairying and a general diversifying of our crops. Within a few years, at the present rate of progress, Iowa will cease to be ranked among the corn surplus states, and not a bushel will be sold for shipment beyond the State lines. Respectfully yours,

J. R. SAGE,

Director I. W. C. S.

MR. SNOW'S SECOND LETTER.

CHICAGO, Sept. 25, 1893.

MR. J. R. SAGE, *Director, etc., Des Moines, Iowa*—DEAR SIR: I am in receipt of your letter of the 22d. Having been for a number of years interested in statistical work, I am pleased to see that the General Assembly has recognized the value of such work by placing Iowa in the list of states having statistical service.

There are certain faults inherent in the system of collecting statistics by assessors which should not be overlooked. Their character is that of taxation officials, and it is an exceedingly difficult matter to divorce them in the minds of the people from that character. As a consequence there is always a tendency to make returns low. It strikes me that with the collection being made for the first time this tendency would be still stronger. Another fact, especially important just now, is the evident desire during the past few years of farmers to minimize crop production.

This tendency of assessors to get their returns too low is shown by the results in states where that system is in force. In Illinois, where both people and assessors have had years of experience, the assessment returns as compared with the National census may be seen, as follows:

	ACREAGE.			
	CORN.		WHEAT.	
	STATE.	CENSUS.	STATE.	CENSUS.
1879	7,919,000	9,019,000	2,441,000	3,219,000
1889	6,988,000	7,861,000	2,053,000	2,240,000

A similar comparison for other states where assessors report agricultural statistics will show similar results.

Your returns evidently give you an acreage in 1892 of about 5,450,000 acres of corn. If that is to be accepted as correct it implies a falling off of more than 2,000,000 acres in your staple crop in three years, in face of the fact that by your own assessment rolls your cattle increased from 3,110,936 to 3,185,064, and hogs from 2,237,359 to 2,692,572 during the same period. I fully appreciate the fact that Iowa farmers are seeking to diversify their crops, but I do not believe it possible that there has been such a violent change among a conservative class in so short a time.

I am interested in the accuracy of such statistics and I point out the possibility of error in such work in order that I may have your views and any confirmation you may have of the accuracy of the figures.

I quite agree with you that the Government figures for 1890 and 1891 were too high, and the figures placed for 1892 is an evidence of my opinion. Truly yours,

B. W. SNOW.

REPLY.

B. W. SNOW, ESQ., *Chicago, Ill.*—DEAR SIR: I am in receipt of your favor of the 25th inst., and note what you say relative to the faults inherent in the system of collecting farm statistics by assessors, and the tendency of farmers to make returns low.

This is undoubtedly true as to all forms of property listed for taxation; but it should be noted that the *acreage* of certain specified crops is not subject to taxation as such. The number of acres in a farm is definitely known, and the farm is listed for taxation regardless of crops grown thereon. After the taxable property is duly listed the assessor is instructed to enter on separate rolls the figures relating to acreage of crops of the previous year, making full explanation that these statistics bear no relation to taxation. Every farmer with a grain of sense knows that he is not taxed on land devoted to corn any more than on pasture or bush lot; so there is no motive for misrepresentation in that respect. As a matter of fact, assessors assure me they have more trouble from the tendency of farmers to exaggerate the extent of their farm operations than from the desire to conceal the facts as to acreage and yield. In some cases farmers return more acres in corn, oats, wheat, meadow, pastures, grove, etc., than the total area of their farms, and the figures must needs be revised.

I am disposed to accept the tabulated returns of our assessors as approximately correct. The figures seem to me to be more reliable than the farm statistics gleaned by the census takers, who pass rapidly over their territory and seldom take time or trouble to find the head of the family if he chances to be absent. Assessors, on the contrary, almost invariably take their figures from the farmer in person. At the best we must make allowance for possible error in any estimate.

As to corn acreage, I believe 6,000,000 to be a conservative estimate. Extended observation convinces me that the area planted in corn does not exceed 25 per cent of the farmed lands of this State. In many counties the corn acreage is less than 20 per cent of the farmed lands.

Respectfully,

J. R. SAGE.

IOWA SOILS IN THE LIGHT OF RECENT INVESTIGATIONS.

BY HARRY FOSTER BAIN, IOWA GEOLOGICAL SURVEY.

There are few people who have not observed that certain soils support particular crops better than others. In certain places wheat thrives best; in others corn gives the largest returns; and elsewhere garden truck grows more vigorously. Thus some localities become famous for certain grains; others for fruits. These are matters of common experience.

Such facts, however, are known to be true not only for broad geographical provinces, but also for minor areas. Differences just as marked often exist between fields on opposite sides of a road. One field brings forth corn strong and luxuriant, bearing heavy ears with full grains, and ripening in due time, while in the neighboring field the plants "all run to stalk," or support only meager, imperfect ears. From the one field a good crop is always to be depended upon; from the other it is almost impossible to obtain an adequate return for the time and money expended; the latter field may, however, prove to be quite remunerative when sown in wheat or other grains;

hough the former cultivated with this crop, may prove a failure.

These facts call for an explanation, and it has been sought by many men in many ways. Chemists have attempted the solution of the problem by a study of the chemical nature of the plants grown, and of the soils supporting them. In this way a vast number of analyses has been made, an equally large number of experiments have been carried on, and a great accumulation of results tabulated. The experiments have differed widely in method and aim, but in general it may be said that they have been largely based on the theory that certain plants exhibit a partiality for particular substances as food, and that they thrive best when that substance is present in the soil in largest quantities, provided it be in a form that a plant can readily use. Thus one of the results of the extensive plot experiments carried on at the Rothamstead Experiment Station in England, has been the belief that phosphates treated with sulphuric acid form the best food for turnips. From these and similar experiments carried on in many places, has grown up the conception that the food matter in a soil may by cultivation become exhausted and need renewal.

While this chemical work has been valuable and while the experiments have proven clearly a certain number of facts, it yet remains an open question whether the difference in soils and the effect of fertilizers used may all properly be referred to the food effects of the very small percentages of nitrogenous and other matter present. The results have been often uncertain and even contradictory, and it is very doubtful if the key to the interpretation of these various phenomena does not exist rather in the physical nature of soils and the changes they undergo. In a broad way the effect of climate is well recognized and for the general distribution of plants the effect of temperature is believed to be sufficient. It is the important economic factor in the production of bananas, figs and oranges and other tropical fruits.

The effects of moisture are not so clearly recognized and while it has long been known that it plays an important part in the distribution of plants in a large way, as that the arid regions only lack irrigation to make them fertile, and that they are arid more because of the lack of water than because of any deficiency in chemical composition, the part which it plays in the local distribution of plants has only recently been studied and clearly set forth.

It is then of great interest to consider in this connection the work of Prof. Milton Whitney of the Maryland Agricultural College and the Johns Hopkins University, who by his patient labors has done much in the last few years to clear up these difficulties. His results have been really startling; indeed almost revolutionary. Nevertheless they are well fortified by philosophical and experimental data, and viewed in the proper light are not contradictory to but rather explanatory of the former work. Professor Whitney's work undoubtedly marks an epoch in the study of soils and the application to soil study of the principles of Geology and Physics, as he has worked them out, will undoubtedly be productive of great scientific and practical results.

Starting from the fact that the farmer is better able to tell from the character and appearance of a soil what grain it would best produce than the chemist by the most elaborate analyses, the eminent investigator was led to believe that the differences in the value of soils was due rather to their texture and the arrangement of grains than to their chemical composition ; that all soils contain sufficient food material to support crops for years, and their value is measured by their relations to moisture.

The matter of the moisture in a soil, or the circulation of water in it, is very important and is believed to be the determining factor in the local distribution of plants. Some plants, as melons for example, require much water at first so as to give a rapid growth. Later they need less moisture that the growth may be checked and the fruit allowed to ripen. Thus it happens that they thrive best on a loose sandy soil, which does not hold the moisture of itself, so that after the rains of the early part of the season they are left with a small supply of water. These same principles are recognized by the florist, and so he is able to raise all kinds of plants on the same soil by proper regulation of the water supply.

The circulation of water in the soil is brought about by two forces—gravity and surface tension. The first is constant and acts always in the one direction, so that for our purposes it may be practically neglected. The second acts in any direction; either pulling the water up to the plant or away from it according to the circumstances. Surface tension is that tendency which any exposed surface has to contract to the smallest possible area consistent with the weight of substance.

If we conceive a mass of water to be made up of a number of molecules of definite size, arranged at certain distances apart, and a mass of air surrounding each, in which, as it is a gas, the molecules are pushed farther apart, it will be readily seen that any given molecule on the surface of the water will have on one side, within a given space, a great many more molecules to attract it than on the other, and thus will be drawn to the side upon which there is the greater number of molecules; that is, it will be drawn toward the center of the mass of water. It will be readily seen further that each molecule on the exterior surface of the water mass will be acted upon in an exactly similar manner. Thus they will all be drawn toward the center, or there will be a tension to decrease the surface. If unhindered this would of course result in the water assuming the form of a sphere. Now if a solid mass be conceived as included in the water it will be seen that the attraction is greatest toward the solid and the water will form a ring around it. The force which thus moves the water is surface tension.

It has been found, that upon an average, fifty per cent by volume of the space within soil contains no solid, but only water and air, or is called empty space. If a soil is slightly moist the water will act as in the second case above and form films around the grains of soil. If there

is more water these films will thicken and the amount of surface exposed being smaller in proportion to the weight of water the surface tension will become low. If, however, the amount of water be decreased the surface tension increases as surface exposed is much greater in proportion to the less weight of water.

The total surface exposure for a cubic foot of soil is on an average 50,000 square feet and in some kinds of soil over two acres. That is, if a cubic foot of granite with six square feet of surface becomes disintegrated into soil, the combined areas of the different particles would be equivalent to 50,000 square feet or more. If there is very little water in the soil, it will be forced to cover a large surface and the surface tension will become very great. If now a cubic foot of soil in this condition be brought in contact with a cubic foot of soil in which there is much water and hence a lower surface tension, the water in the latter will be drawn to the former until the two are equalized, whether it be drawn up, down, or sideways. This surface tension is a constant definite force per square foot for any substance at a given temperature. In liquids it may be changed by putting various things into solution. For example, if lime, kainite or salt be added to water the surface tension is increased and if a cubic foot of soil in which the water is charged with salt be brought in contact with soil in which the water is pure the water will be drawn from the latter soil into the former for the same reasons as in the case just explained. On the other hand the addition of acid phosphate, plaster or ammonia tends to lower the surface tension of water.

Another interesting phenomena is that of flocculation. It is known that a muddy liquid will remain turbid for an indefinite time, but if a trace of lime or salt be added to the water the grains of clay flocculate or come together in a loose, flaky mass and settle to the bottom.

It will be remembered that if water be brought in contact with solid matter the tendency is for it to be drawn toward the solid body and to spread over it. Thus it is seen that there are forces which cause water to increase its surface. This has been called surface pressure. Now, if two clay particles be conceived to be surrounded by films of water and brought within the sphere of each other's attraction, it will be seen that they will be attracted toward each other if the surrounding films of water are in a condition of surface tension, as the effect will be to decrease the surface. If, on the other hand, the condition of surface pressure exists they will be repelled as by union the amount of surface would be decreased. As surface pressure is seen to be negative surface tension, by regulating this surface tension the particles in the soil may be drawn closer together or thrown farther apart.

These principles may be applied to the treatment of soil. Heretofore the application of fertilizers to soils has rested upon empirical rather than scientific principles. While good has often been accomplished, harm has also been done. This is frequently seen where a fertilizer when first applied to a particular soil, seems to do good, but in a few years ceases to be active, and the soil may even be injured by it. This is due to the permanent change in the texture of the soil, which is often easily discernible by the eye, and which results from the action of the fertilizer.

When fertilizers are applied to a soil two effects are produced, one being immediate and transient, and the other remote, but permanent. The first consists in the change in the surface tension of the soil moisture, resulting from the solution of the various salts in the fertilizer, by which means the water is either drawn up from below and the moisture increased, or it is allowed to pass down and the moisture decreased. The second effect is not so rapidly produced, and is the result of the action of the solvent in pulling the grains close together or pushing them farther apart. This is the effect which is permanent, and which changes the nature of the soil with relation to the circulation of water in it.

The rapidity of the flow of water through a soil is dependent upon the manner in which the empty space in it is divided up. In a clay soil, where the grains are close, the open passages will be smaller and regular, and the rate slow. In a sandy soil, with large spaces, irregularly arranged, the rate will be more rapid. Water will flow most rapidly through a soil in which the passages are irregular, some quite large while others are very small, rather than in the one in which they are of the same size.

This matter of the division of space in the soil is found to be dependent upon its mechanical composition; that is, upon the percentage which it contains of fine gravel, sand or clay. This may be learned by mechanical analysis, and has been found to be constant for a given soil type.

By these means it has been found that lands which are the best wheat and grass producers have a high percentage of the finer materials known as silt and clay. Such soils result from the disintegration of certain rocks, usually limestone. Other crops require a soil with a less percentage of clay and a greater amount of the coarser material, soils which are formed in a different manner.

The study of the origin of soils and their correct delimination in the field is properly the work of the geologist. A knowledge of a soil types will be of little value without the aid of an accurate and detailed soil map upon which the distribution has been traced. Thus the relation of Geology and Agriculture are daily becoming more intimate. The geologist must distinguish and map the different formations, each of which has its peculiar characters and its soil types. The agricultural physicist must study and explain these soil types and where any of them fail of the full measure of production, must study the symptons, discover the cause and announce the remedy. Only in this way can the farmer, and through him the whole community obtain the full measure of value from the soil. All must work together for this end.

In Iowa a number of soil types may be distinguished and mapped. In the northeastern portion of the State, in the driftless area, the soil is made up of the residual clays, resulting from the decay of the underlying rocks,

which are in most cases limestones. These soils, as explained above, contain a higher percentage of clay, and hence have become famous as wheat lands.

The Loess, which covers large portions of our State, is a well marked soil type. Although somewhat variable in composition, it may in general be said to be rich in clay and usually also in lime. It is fine, homogeneous, yields readily to the plow, absorbs water like a sponge and holds it well. It is famous the world over for its richness and in Iowa can frequently be mapped by its vineyards and orchards as well as the general air of prosperity in the farming communities built upon it.

Another soil type quite common here is the alluvium. This is usually confined to the flood plains or rivers and the terraces along the banks. It is largely dependent in character upon the country rocks, and must be carefully mapped. It is usually characterized by fineness of material and great productiveness.

The drift, while much more constant than would at first be supposed, presents a variety of soil types and necessitates a considerable amount of study. Between the newer and the older drift sheets considerable difference in character can be distinguished, mainly in the degree of oxidation of its materials.

Another soil type found in a number of places and quite well developed in Johnson county along the Iowa river, and also near its mouth, is the deposit known as gumbo. This is a fine clay formation usually of little agricultural value. It is almost impervious to water and forms the home of the craw-fish. This soil is in many places helped by underdrainage and when reclaimed is of considerable fertility. It is probable that the grains of clay in it are too closely packed together, and that its texture could be modified to advantage by the use of proper chemicals at small expense. This is, however, a matter requiring considerable future study.

The soils of Iowa are remarkably fertile, yet as has been shown, there are differences in the degree of this fertility and differences in the adaptability of the different soil types. A proper insight into these differences and a culture recognizing them and founded upon scientific principles would doubtless add largely to the returns now obtained. Such knowledge of the nature of the soils and the best manner of their treatment can only be acquired by a careful and thorough study of the soils themselves. Thus crops may be doubled with little additional labor, and all danger of the "wearing out" of the soils obviated.

THAT ATLANTIC CYCLONE.

In the August *Monthly Review* page 2, there was a statement that the South Atlantic storm "struck the coast of Florida on August 27th, raging with terrific force through eastern Georgia, South Carolina, North Carolina and Virginia, causing great loss of life and immense destruction of property in its pathway through those States." In the course of the article it is implied that those of us living east having some idea of the general destructiveness of a cyclone are impressed with the thought that the western people are "awfully tempest-tossed and greatly to be pitied" in their tornado visitations. "Our prairies are occasionally plowed by small-bored tornadoes, but they are mere pin scratches compared with the immense sweep of the cyclones which are born of the heat and moisture of the tropical waters. * * The Mississippi Valley is happily exempt from the cyclones and hurricanes of the West Indies' type"

I am gratified that the people of the western states are beginning to speak about small-bored tornadoes for I have taken every possible occasion to call attention to the fact that the western tornado evil has been most seriously exaggerated.

However, in the interest of truth, it is very essential that there be a word of explanation regarding the general destructiveness of cyclones of the South Atlantic type. Since these storms have their birth upon a water surface, it is plain that the winds are very violent because of the less friction, but the moment they reach the land the great velocity of the wind is checked, and they are no greater than occur in almost any month in the west. A good example is the violent storm of October 6th, in the lake region. Instead of there having been "great loss of life and immense destruction" through South Carolina, North Carolina and Virginia, in the storm mentioned above, Aug. 28th, so far as reported, there was not a single loss of life, and the destruction was only of weak structures and tree branches, with one exception; this was at Kernsville, North Carolina; this town was visited by a genuine western tornado, which killed one person and wrecked one hundred houses. I was in the center of this Atlantic storm, and except for a blind slamming until I got up and fastened it, there was no sign of an extreme wind.

The loss of life in this storm and the still greater loss in the more recent storm of October 1, on the Gulf, just south of New Orleans, was due to the enormous waves which were raised and caused to spread over the coast where these people lived in insecure houses. In no case, I think, was death caused by the wind directly or by the wind blowing structures upon people. Such a wave once caused the death of 100,000 people in India who were living on the low lands near the Bay of Bengal. This wave was raised by the wind also. It is the more important that there should be a correct understanding of the facts in this case because I happen to know of scores of people who were very much terrified at the thought of a cyclone, expecting that it would have the violence and distructiveness of the western tornado. There is so much confusion in the use of the term "cyclone" that I very much wish it could be discarded throughout the length and breadth of this land. The words Atlantic storm, or severe Atlantic storm would be vastly better to use, and wind-rush or tornado for the western states. H. A. HAZEN.

WASHINGTON, D. C., Oct. 6, 1893.

In the article in the August *Review*, referred to by Prof. Hazen, we stated that "the loss of life on the islands and low lands along the coast was caused mainly by the heavy

waves." It should be noted however, that a wind of sufficient force to cause such immense waves to flow so far inland, must be very destructive to light structures and crops. And we are warranted in the statement that the cyclone of August 27-29 caused vastly greater damage to crops and property within an area no larger than the State of Iowa, than has resulted from all the wind storms that have visited this State since its settlement. Prof. Hazen says Kernsville, N. C., "was visited by a genuine western tornado." Wherefore "western"? Are tornadoes indigenous at the west, and exotics in the east and south? The records do not warrant such a conclusion.

SEPTEMBER WEATHER REPORT.

September was warm and dry, the severe and damaging drought of the summer extending till near the close of the month. The mean temperature for the State, as shown by the records of seventy-two stations, was 64.7°, which is about 2.7° above the normal. The highest temperature of the season was recorded at the Central Station on the 6th, and at other stations on the 7th.

The average precipitation shown by records of seventy-seven stations, 2.34 inches, was about 1.36 inches below the normal for September. The bulk of this rainfall came on the last three days of the month. During the first half of the month only a trace of rain was noted in any part of the State.

The distribution of rain, as shown by the chart, was very unequal, the larger part of the State receiving from one to two inches.

All crops were ripened and placed beyond danger before the occurrence of the first killing frost, on the 25th.

The following table gives, as a basis of comparison, the mean temperature and total rainfall for the month of September, at the stations named, for the years from 1872 to 1893, inclusive:

YEARS.	MEAN TEMPERATURE, DEGREES.						PRECIPITATION, INCHES.					
	Des Moines.	Davenport.	Dubuque.	Keokuk.	Omaha.	Sioux City.	Des Moines.	Davenport.	Dubuque.	Keokuk.	Omaha.	Sioux City.
1872	....	65	....	68	62	....	.....	5.30	.....	2.26	3.24	....
1873	....	62	59	64	60	....	.....	1.00	1.53	3.37	1.86	....
1874	....	65	65	68	63	....	....	7.86	7.68	7.92	7.18	....
1875	....	62	62	64	62	....	.....	4.05	7.11	4.62	2.55	....
1876	....	62	61	65	62	....	.....	5.50	5.90	11.08	4.93	....
1877	....	67	66	69	66	....	.....	1.45	0.67	3.61	2.05	....
1878	68	65	64	67	64	....	2.00	1.82	6.94	1.36	3.22	....
1879	60	60	59	64	62	....	2.79	1.43	2.98	1.12	1.43	....
1880	62	63	61	66	63	....	5.34	4.87	6.84	3.21	2.91	....
1881	66	70	66	73	66	....	4.70	5.59	10.26	4.10	8.36	....
1882	64	64	63	66	68	....	0.15	1.39	2.90	1.52	0.51	....
1883	59	61	59	63	61	....	1.88	0.73	2.09	1.76	4.53	....
1884	68	70	63	71	69	....	5.46	4.79	4.07	4.25	4.91	....
1885	64	63	62	65	64	....	4.82	4.19	4.58	3.77	2.50	....
1886	65	66	64	69	65	....	7.93	2.43	3.10	3.95	4.45	....
1887	64	64	62	77	65	....	5.36	5.45	7.62	3.13	2.44	....
1888	58	58	57	63	61	....	0.48	1.38	2.01	2.13	0.24	....
1889	63	63	63	64	64	61	3.41	3.27	1.54	5.14	1.74	1.71
1890	61	60	60	63	63	62	1.57	2.34	3.72	4.46	2.50	2.36
1891	68	70	69	71	70	68	1.64	1.50	0.68	0.49	1.76	0.91
1892	66	66	64	67	68	66	1.12	2.09	3.79	3.21	1.63	0.57
1893	66	66	64	69	68	66	1.33	3.36	3.31	3.18	1.72	1.11
Means	64	67	63	65	64	65	3.12	3.26	4.29	3.68	3.02	1.33

SUMMARY OF WEATHER CONDITIONS.

BAROMETER—Mean pressure for month, 29.94 inches. Highest observed, 30.38 inches, at Dubuque on the 28th. Lowest barometer observed, 29.48 inches, on the 30th, at Omaha (Neb). Range for the entire State, 0.90 inches.

TEMPERATURE—Monthly mean, as determined from 72 voluntary observer's reports, 64.7°. Highest monthly mean, 71.4°, at Glenwood. Lowest monthly mean, 57.0°, at Osage. The highest temperature reported was 102° at Glenwood on the 8th. The lowest temperature was 18°, at Rock Rapids and Sibley on the 25th and 27th respectively. Average daily maximum, 79.1°; average daily minimum, 50.5°; average monthly maximum, 29.2°. Average monthly range, 65.2°. Greatest monthly local range, 80°, at Rock Rapids. Range for the entire State, 84°.

PRECIPITATION—Average for the State as determined from 77 voluntary observer's reports, 2.34 inches. Greatest amount reported, 5.49 inches, at Seymour. Least amount reported, 0.74 inches, at Rock Rapids. Average number of days on which .01 inch or more rain fell, 4.1; clear days, 19.6; partly cloudy, 6.4; cloudy, 4.1.

HAIL—Richland on the 21st.

LUNAR HALOS—Murray, 21st; Monticello, 24th, 28th; Amana, 28th.

SOLAR HALOS—Murray, 28th; Monticello, 11th; Ovid, 25th; Hopeville, 28th.

AURORA—Faint low arch visible at Cresco on the 8th; Alta, 7th.

FOG—At Hampton on 18th.

LIGHT FROST—Reported quite general throughout the State on 15th, 16th, 22d and 24th.

KILLING FROST—Reported on the 16th in northern part of the State, and general throughout the State on the 25th and 27th.

ATMOSPHERIC PRESSURE.

STATIONS.	Mean reduced barometer.	EXTREMES.			
		Highest barometer	Date.	Lowest barometer	Date.
Cresco	29.95	30.37	27	29.53	21
Clarinda	29.81	30.20	2	.....	....
Cedar Rapids	29.93	30.24	27	29.54	30
Davenport	29.98	30.35	28	29.60	21
Des Moines	29.96	30.35	27	29.53	30
Dubuque	29.97	30.38	28	29.62	21
Keokuk	29.97	30.34	27	29.58	30
Omaha, Neb	29.95	30.38	27	29.48	30
Sioux City	29.91	30.36	27	29.48	30
Means	29.94	30.38	....	29.48	....

WIND MOVEMENT.

STATIONS.	Miles.	Maximum velocity.	Direction.	Date.
Davenport	6.115	35	SW	21
Des Moines	5.270	35	SW	21
Dubuque	3.529	30	SW	21
Keokuk	4.111	36	W	21
La Crosse, Wis	4.967	40	W	15
Omaha Neb	5.039	25	NW	15
Sioux City	6.878	36	NW	15

OBSERVERS' NOTES.

Williams—MERTON L. FULLER: The drought which began August 24th, continued, with the exception of a single fog or mist, for twenty-five consecutive days—the longest absolute dry spell in seven years.

Richland—W. A. SHAFFER: Ice formed one-fourth inch thick on the 24th. The severest storm of the season on the 21st, accompanied by loud thunder, high wind, and hail three-fourths of an inch in diameter.

Amana—CONRADT SCHADT: Hazy and smoky up to the 13th. Pelicans on the lake on the 19th. Wild geese flying south on the 21st.

College Springs—A. A. BERRY: First half of the month very dry, and pastures suffered. Fall wheat acreage will hardly be up to the average. As good a crop of corn as Page county ever had. Plenty of feed, and not much fodder saved.

Belle Plaine—H. W. VANDIKE: The drought of this month has been unprecedented. No rain to wet the ground from August 15th to September 29th.

Cedar Rapids—H. D. Olds: The month has been almost without rain; but .06 of an inch of rain fell between August 23d and September 29th. Pastures suffered severely and the ground was too dry for plowing. Water for stock is very scarce.

Bonaparte—B. R. VALE: With only 2.40 inches of rain in July and 2.02 in August, and no rain from August 15th until September 20th, it was the most intensely dry period we ever had. The soil drank up the rain (5 inches) but it did not start the streams.

Keosauqua—JOHN H. LANDES: The hottest weather this year was September 6th and 7th; maximum temperature, 98°. The night of the 18th the minimum thermometer did not reach below 74°—the hottest night of the year.

CORRECTION OF DATA.

The precipitation at Fulton, Iowa, for August, 1893, amounted to 1.75 inches, instead of 1.12 as recorded.

At Galva, Iowa, on August 22d, the precipitation was .18 of an inch, instead of .88 as recorded in the REVIEW for that month.

Clinton—DR. LUKE ROBERTS: The general meteorological conditions of September, 1893, compare favorably with its predecessors during the last 15 years. The maximum temperature was 96 degrees, which is 5.1 degrees above a September average for the last 12 years. The minimum temperature was 31 degrees, or 3.1 degrees below normal. The mean temperature was 63 degrees, or 1.7 degrees above average for the past fifteen Septembers. The warmest day was the 14th, the mean temperature being 77 degrees, or 2 degrees above normal for September's warmest days. The coldest day was the 25th. The mean temperature was 41 degrees, or 3.4 degrees below a mean of like days.

The first 18 days of the month were destitute of rain. No rain fell from the 16th of August to the 18th of September. A severe and damaging drouth resulted, which prematurely ripened corn, seriously damaged the potato crop and rendered most pastures useless so that stock had to be fed from the winter's store. The Mississippi river came within a few inches of low water mark. On the 18th the drouth was partially broken by a modest shower, which was followed on the 20th by a little more, and on the 21st a copious rainfall gladdened all nature. The precipitation amounted to 1.54 inches—was warm, and accompanied with thunder and lightning. The 22d and 24th furnished a little rain, and on the 29th a copious precipitation occurred, the storm extending over to the 30th, with a total fall of 2.18 inches of water. Total precipitation for the month was 4.25 inches. Although the rainfall all came in the latter part of the month the amount exceeded a September average by 1.21 inches.

During the fore part of the month the movement of the wind was very light, but at the close of the month had nearly made up a September average. Total movement 2,960 miles. Maximum velocity 20 miles an hour. Prevailing direction, northeast

On the morning of the 25th the first frost of the season made its appearance; on the 26th a very heavy or killing frost, the temperature of the air going one degree below freezing; on the 27th was another lighter frost.

On the evening of the 1st a brilliant meteor was observed. On the evening of the 30th the temperature began to rise.

METEOROLOGICAL DATA FOR SEPTEMBER, 1893.

STATIONS.	TEMPERATURE OF THE AIR (IN DEGREES FAHRENHEIT.)								Precipitation in inches—monthly.	Prevailing direction of wind.	Killing frost—first of autumn.	No. of cloudless days.	No. of partly cloudy days.	No. of cloudy days.	No. of rainy days. (.01 inch or more).	No. of hail-storms.	No. of thunder-storms.
	Monthly mean.	EXTREMES. Mean maximum.	Mean minimum.	Maximum.	Date.	Minimum.	Date.	Monthly range.									
Algona	62.8	....	.....	93	6	37	25	66	1.90	NW	25	23	6	1	2		1
Alta	64.6	79.2	50.0	95	5	24	25	71	1.02	SE	25	22	7	1	4		
Ames (W. R. Cooper)	62.2	80.4	44.4	96	6	24	28	72	1.87	SE	....	21	7	2	2		
Ames (W. H. Helleman)	....	.....	.....	.....	.....	.....	.....	.....	1.88	.....	.....	.....	.....	.....	.....		
Ames (4 miles southwest of)	67.7	.....	.....	100	30	30	25	70	1.86	SW	25	19	8	3	3		1
Amana	63.4	77.4	49.4	93	7	28	26	65	2.63	S	26	18	11	1	6		
Audubon	63.5	80.9	46.2	94	4	25	25	69	1.48	SW	16	18	9	3	2		
Belle Plaine	65.3	80.0	50.6	92	7	26	26	66	1.96	SE	25	....	....	....	4		
Blakeville	67.6	.....	.....	100	7	32	26	68	0.85	NE	....	14	6	10	2		
Bonaparte	67.5	83.2	51.8	100	6	31	26	69	5.13	.....	.....	.....	.....	.....	6		
Carroll	62.9	78.1	47.6	93	4	23	25	70	1.36	.....	25	25	1	4	2		
Cedar Falls	64.2	81.7	46.8	99	7	26	26	73	1.75	NW	....	22	2	6	5		1
Cedar Rapids	64.8	76.7	53.0	90	7	33	25	57	3.85	E	25	23	5	2	3		
Centerville	65.9	81.0	50.8	95	7	24	25	71	4.20	NW	....	....	....	....	....		
Charles City	62.9	76.4	49.4	93	7	28	25	65	1.77	S	25	24	2	4	3		
Clarinda	65.9	77.5	54.4	90	21	36	25	54	3.38	S	25	20	4	6	5		
Clinton	64.4	78.0	50.8	96	14	31	26	65	4.25	NE	26	13	12	5	6		
College Springs	64.7	78.1	51.2	91	13	29	25	62	3.29	S	25	....	....	....	4		
Corning	64.7	78.1	51.2	91	6	29	25	62	1.70	SW	25	19	6	5	4		
Cresco	60.5	74.9	46.1	92	6	26	25	66	2.08	.....	25	....	....	....	3		1
Davenport	66.6	77.8	55.0	96	7	37	25	59	3.36	SW	25	13	9	8	7		1
Decorah	63.3	78.1	48.6	91	7	25	26	66	1.15	.....	....	20	7	3	3		
Delaware	59.8	.....	.....	98	7	30	....	68	2.39	S	25	20	7	3	5		
Des Moines	66.0	79.2	53.2	95	6	33	25	62	1.33	SW	25	20	7	3	4		
Des Moines (5½ miles southeast of)	64.9	77.8	52.0	94	7	32	25	62	2.18	SE	25	15	11	4	3		
Dubuque	64.0	75.8	52.0	94	7	32	27	62	3.31	SE	25	16	7	7	5		
Elkader	62.6	79.8	45.5	100	7	23	26	77	1.48	E	26	23	5	2	5		
Ft. Madison	69.2	.....	.....	93	4	40	25	53	4.88	NE	....	13	10	7	6		
Fulton	64.9	.....	.....	.....	.....	.....	.....	.....	1.14	SE	....	3	19	8	3		
Galva	63.5	80.2	50.0	95	6	26	25	69	1.48	SW	16	....	....	....	4		
Glenwood	71.4	86.5	56.2	102	8	34	25	68	1.35	S	16	20	7	3	2		
Grand Meadow	61.1	.....	.....	86	4	31	28	55	2.01	NW	25	16	9	5	3		
Greenfield	67.8	81.2	54.0	94	13	30	25	64	2.92	S	25	22	5	3	4		1
Grinnell	62.1	72.9	52.1	.....	.....	.....	.....	.....	2.38	.....	25	....	....	....	4		
Grundy Center	62.5	78.2	46.8	94	7	26	27	68	1.50	SE	25	22	6	2	4		1
Hampton	62.2	77.6	46.7	94	7	24	28	70	1.54	SE	25	20	6	4	5		
Hopeville	67.1	78.9	55.4	94	13	33	25	61	3.27	SW	25	13	16	1	5		
Hopkinton	67.6	.....	.....	98	7	34	25	64	3.30	SE	25	16	7	7	5		
Humboldt	....	.....	.....	.....	.....	.....	.....	.....	.92	S	26	24	4	2	3		
Independence	63.6	79.3	47.9	96	7	26	26	70	1.15	NW	....	24	2	4	3		
Indianola	64.9	76.5	52.9	93	6	33	26	60	2.76	SW	25	14	10	6	7		1
Iowa City	65.2	79.4	51.1	95	7	28	26	67	3.07	SE	....	17	7	6	6		1
Iowa Falls	62.6	78.7	46.5	94	7	26	25	68	1.44	SW	25	26	1	3	3		
Jefferson	66.0	83.4	48.6	95	7	28	25	67	1.58	NW	....	19	10	1	4		
Knoxville	66.4	80.2	52.6	95	7	31	25	64	2.67	S	....	14	8	8	6		
Keokuk	69.0	80.0	57.0	97	6	37	25	60	3.18	SW	25	15	8	7	7		
Keosauqua	68.5	82.3	54.7	98	7	34	26	64	5.46	.....	.....	.....	.....	.....	7		
Le Claire	....	.....	.....	.....	.....	.....	.....	.....	2.01	.....	.....	.....	.....	.....	.....		
Larrabee	63.7	80.1	47.3	97	6	23	25	74	1.24	S	16	24	5	1	2		
Logan	66.8	81.9	51.7	95	4	31	27	64	1.35	S	27	20	3	7	3		
Maquoketa	62.3	.....	.....	92	4	32	26	60	3.22	.....	.....	.....	.....	.....	4		
Mason City	62.3	76.8	48.1	93	7	30	28	63	1.82	.....	25	16	3	11	4		
Maxon	66.7	.....	.....	.....	.....	.....	.....	.....	3.11	.....	25	15	11	4	5		
Mechanicsville	63.0	76.2	49.7	91	7	31	25	60	2.77	NW	....	15	8	7	7		
Monticello	62.6	75.1	50.2	90	7	29	26	61	2.50	NW	25	21	5	4	5		
Mt. Vernon	65.9	.....	.....	92	7	33	25	59	3.70	.....	.....	.....	.....	.....	.....		
Murray	....	.....	.....	.....	.....	.....	.....	.....	3.70	.....	....	20	5	5	5		
Newton	64.5	79.1	50.3	93	7	30	25	63	2.11	NW	....	22	4	4	3		
Omaha	68.0	80.1	56.9	93	7	34	25	59	1.72	SE	25	23	5	2	3		1
Osage	57.0	....	....	....	....	....	....	....	1.81	SE	24	....	....	....	4		
Oskaloosa	65.8	80.1	51.5	97	7	29	26	68	2.37	SW	25	19	5	6	4		
Ovid	67.6	.....	.....	96	14	30	25	66	3.36	.....	.....	.....	.....	.....	4		
Panama	66.0	80.1	51.9	93	7	29	25	64	1.35	S	25	23	4	3	3		
Richland	65.5	.....	.....	.....	.....	.....	.....	.....	5.30	.....	.....	11	18	1	6	1	1
Rock Rapids	61.8	80.0	43.5	98	6	18	27	80	0.74	S	25	28	1	1	1		1
Seymour	66.1	80.8	51.5	95	8	30	25	65	5.49	S	25	20	0	10	7		1
Sibley	60.9	77.0	44.8	93	6	18	25	75	0.88	NW	25	24	4	2	2		
Sioux City	66.0	79.4	52.0	95	6	29	27	66	1.11	SE	16	23	4	3	3		
Spirit Lake	....	82.1	.....	100	7	.....	.....	.....	1.14	SE	27	24	3	3	3		1
Storm Lake	66.7	80.4	52.9	92	6	27	25	65	0.95	SE	25	25	4	1	3		2
Tipton	64.9	78.8	50.8	97	7	32	25	65	3.39	NW	25	19	5	6	5		
Villisca	62.4	78.3	48.0	88	17	32	24	56	1.99	..	....	....	....	....	....		
Vinton	63.3	.....	.....	.....	.....	.....	.....	.....	1.85	NW	25	26	0	4	3		1
Washington	68.4	.....	.....	.....	.....	.....	.....	.....	4.24	SW	25	....	....	....	6		
Webster City	65.4	.....	.....	94	7	30	25	64	1.00	SE	25	21	7	2	1		
Williams	61.4	.....	.....	94	7	25	25	69	1.49	SE	16	20	8	2	5		1
Winterset	66.2	80.3	52.2	96	6	31	25	65	2.77	S	25	18	5	7	4		
Means	64.7	79.1	50.5	94.5	.....	29.2	.....	65.2	2.34	.....	....	19.6	6.4	4.2	4.1	..	..

DAILY AND MONTHLY MEAN TEMPERATURE FOR SEPTEMBER, 1893.

STATIONS.	DATE.																														Monthly Mean.
	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	
Algona	60	59	70	71	72	75	74	74	75	72	72	70	74	66	61	54	72	71	58	68	64	58	46	47	39	46	52	46	51	65	62.8
Alta	66	58	71	74	74	77	76	74	76	74	69	72	75	69	62	56	69	76	58	70	72	59	50	57	40	50	46	51	51	64	64.6
Ames (W. B. Cooper)	62	57	64	66	74	78	77	72	74	64	67	69	73	75	62	53	64	64	60	66	72	62	52	54	40	50	48	46	44	57	62.2
Ames (4 miles sw of)	66	64	70	76	82	85	80	79	80	75	78	74	76	70	68	60	70	74	66	70	78	61	59	54	42	50	51	52	58	64	67.8
Amana	63	57	62	72	71	74	78	72	69	67	70	68	70	75	66	58	64	73	67	63	78	59	56	54	43	47	51	47	48	61	63.4
Audubon	66	56	68	74	72	74	76	71	73	68	67	71	74	75	60	54	69	76	62	70	66	58	50	58	42	48	49	52	47	68	63.6
Belle Plaine	62	58	64	72	72	74	76	72	75	70	72	72	72	76	66	54	68	75	62	....	....	....	....	....	....	46	48	48	48	63	65.3
Blakeville	68	65	68	75	73	81	83	76	78	78	74	75	72	72	65	69	74	77	72	72	70	72	62	54	49	50	49	50	53	53	61.6
Bonaparte	66	62	64	76	76	78	82	77	72	71	76	74	76	80	74	60	68	80	72	66	81	65	58	52	45	50	54	53	51	65	67.5
Carroll	67	65	75	78	70	72	71	70	70	72	70	66	74	60	62	53	66	63	71	74	58	55	52	55	39	50	48	47	51	60	62.9
Cedar Falls	65	60	65	72	74	76	78	76	74	72	72	72	75	76	62	58	64	74	68	66	71	60	52	52	44	46	48	48	55	54	64.2
Cedar Rapids	64	59	64	72	72	73	78	73	69	69	72	70	75	66	67	66	66	76	68	66	78	65	52	52	44	48	49	48	56	58	64.0
Centerville	62	63	70	70	73	75	78	67	75	72	71	72	75	78	65	65	66	69	68	72	74	67	63	55	47	51	44	48	50	58	65.9
Charles City	66	59	66	73	71	75	76	75	74	72	73	70	76	71	58	55	66	73	60	68	71	54	51	52	42	44	43	44	47	60	62.9
Clarinda	64	58	66	72	73	72	75	74	76	70	72	72	77	72	67	56	66	76	66	72	75	60	56	58	46	52	55	54	....	67	65.9
Clinton	66	59	62	71	72	73	76	72	70	72	74	72	77	80	68	59	62	72	70	62	76	62	58	48	46	48	52	51	46	56	64.4
Corning	64	54	67	72	70	72	75	73	74	67	68	70	76	70	65	54	68	71	64	71	80	60	54	59	48	48	54	60	55	66	64.7
Cresco	62	56	66	72	70	74	75	70	70	66	69	70	66	67	56	52	60	75	63	62	70	56	48	50	40	44	44	45	44	52	60.5
Davenport	68	60	66	78	77	74	82	73	70	72	74	72	76	81	72	60	66	74	70	64	78	64	60	50	46	51	55	52	40	59	66.4
Decorah	57	63	71	76	68	74	76	80	71	68	70	72	71	64	58	59	74	70	67	66	69	54	52	51	40	44	44	51	52	58	63.3
Delaware	62	56	63	68	68	70	75	66	64	64	66	67	70	70	58	50	62	70	62	62	69	56	50	49	39	44	44	44	47	57	59.8
Des Moines	64	59	68	74	74	78	80	76	74	71	70	72	77	76	55	58	68	80	65	68	80	60	54	59	45	50	52	52	51	64	66.2
Des Moines (5½ miles se of)	64	58	66	72	72	72	80	74	74	68	68	70	76	74	65	54	68	76	65	68	79	59	54	56	41	52	50	50	55	64	64.9
Dubuque	68	60	66	75	69	74	81	70	70	71	72	68	70	78	68	59	63	72	70	60	76	62	58	50	44	49	48	48	46	54	64.0
Elkader	63	59	63	74	69	72	86	72	73	70	70	70	71	76	59	59	59	74	70	59	78	59	53	49	45	45	46	44	54	64	62.6
Ft. Madison	70	69	70	83	76	82	79	79	66	72	76	67	78	83	76	63	74	80	72	68	76	68	61	53	49	56	55	59	52	67	69.2
Fulton	62	57	69	72	72	70	74	72	66	76	76	71	71	76	62	53	71	71	66	66	76	62	57	48	42	48	48	50	48	60	64.9
Galva	60	56	70	73	72	76	76	75	75	73	69	72	76	68	61	71	70	77	65	70	72	57	66	56	40	52	49	51	52	63	64.6
Glenwood	74	62	72	77	79	78	82	83	80	76	71	81	81	72	69	59	70	82	73	80	84	73	57	62	58	52	64	60	59	70	71.4
Grand Meadow	62	58	67	70	67	74	74	67	66	71	68	69	68	68	60	55	66	76	60	64	68	60	50	51	41	46	44	47	46	56	61.3
Greenfield	63	58	68	78	76	78	78	79	76	70	72	78	80	74	68	56	72	80	82	68	76	64	54	59	44	56	54	52	55	66	67.8
Grinnell	....	....	....	....	....	....	....	....	....	....	....	....	....	75	68	58	70	76	66	66	81	61	56	57	47	54	54	50	53	64	62.1
Grundy Center	56	60	67	71	73	76	76	72	70	68	68	70	74	69	58	58	71	66	64	68	64	59	50	47	42	48	44	48	50	64	62.5
Hampton	61	57	65	70	70	74	77	73	72	70	68	68	72	72	62	54	63	76	60	65	74	58	49	54	40	48	46	44	46	58	62.2
Hopeville	67	62	68	74	75	78	80	77	76	70	72	72	78	74	68	59	70	76	66	72	77	62	55	56	45	52	56	52	56	67	67.1
Hopkinton	69	65	69	52	73	79	83	76	72	72	73	73	74	77	65	65	72	71	68	64	73	66	56	54	76	57	54	54	74	60	67.6
Independence	66	58	65	72	72	74	80	72	70	70	72	71	72	76	63	56	65	74	66	65	72	58	57	49	44	46	48	48	54	54	63.6
Indianola	....	64	72	73	74	77	79	76	73	70	68	71	76	75	69	57	68	76	65	68	79	60	54	56	49	50	....	61	52	71	64.9
Iowa City	64	60	64	70	72	76	80	72	72	70	75	70	76	71	67	59	64	76	68	68	78	64	62	52	46	48	52	52	50	60	65.2
Iowa Falls	55	....	64	67	72	74	76	74	74	68	69	68	72	70	62	54	64	75	59	68	72	57	49	47	42	48	44	48	60	....	62.6
Jefferson	67	56	68	78	72	76	70	76	76	74	69	71	75	75	67	56	68	76	66	68	69	60	52	58	51	50	58	50	59	62	66.9
Knoxville	66	60	66	75	74	76	76	77	74	73	74	74	77	78	70	60	68	78	65	66	80	64	55	55	42	50	51	52	50	66	66.4
Keokuk	68	64	67	79	79	80	82	78	71	72	76	73	75	83	76	61	68	84	69	68	70	68	61	54	46	52	56	56	51	66	69.0
Keosauqua	66	63	66	78	77	78	81	78	72	70	76	73	76	81	72	62	68	82	74	68	80	64	60	53	48	50	....	53	53	64	68.5
La Crosse (Wis)	64	58	64	74	70	71	72	70	71	72	68	71	72	75	60	58	59	78	66	62	75	54	72	50	45	46	44	46	48	52	63.0
Larrabee	60	58	70	74	75	78	76	75	78	75	70	71	76	68	60	54	71	76	56	72	66	57	48	54	40	46	44	52	50	64	63.7
Logan	64	60	72	74	71	74	78	74	77	73	67	74	78	69	61	56	71	77	63	74	80	71	53	58	46	55	50	57	60	68	66.8
Maquoketa	62	57	67	71	70	71	70	68	70	70	76	68	66	67	65	53	68	72	70	68	70	62	52	49	44	47	49	49	49	55	62.8
Mason City	62	56	63	70	71	71	72	71	72	70	68	66	66	70	60	54	66	76	72	60	61	58	64	56	48	53	54	46	51	58	62.5
Maxon	66	62	71	76	74	76	76	78	73	70	70	75	78	75	66	57	80	79	68	68	75	56	55	52	43	54	52	56	51	68	66.7
Mechanicsville	64	56	62	72	70	70	78	70	67	67	70	68	73	74	68	55	64	74	71	62	76	60	56	50	42	43	49	48	46	58	63.0
Monticello	60	55	63	69	70	73	78	69	69	69	71	69	75	73	65	51	70	70	63	66	74	62	52	50	45	48	45	47	48	60	62.6
Mt. Vernon	66	62	70	78	76	76	83	72	70	71	70	72	78	76	66	57	76	74	66	68	72	63	54	52	44	53	50	52	50	62	65.9
Newton	64	58	64	71	73	86	77	74	72	68	71	70	74	74	64	56	65	75	68	64	78	60	54	54	44	52	50	50	52	62	64.6
Omaha (Neb)	68	63	73	76	75	79	79	76	78	76	71	76	80	74	69	59	73	78	64	74	78	66	56	62	46	53	54	55	60	68	68.5
Osage	58	50	63	64	66	68	68	66	66	64	65	64	70	67	57	49	64	72	56	62	64	50	44	42	34	41	36	39	44	58	57.0
Oskaloosa	64	58	64	78	74	77	81	74	71	70	72	72	76	77	65	59	69	78	68	66	74	61	57	55	44	48	52	52	52	67	65.0
Ovid	63	61	67	74	76	76	76	72	70	73	72	79	73	66	58	76	77	65	66	76	74	56	53	42	54	52	54	52	52	67	67.6
Panama	64	58	68	73	72	76	77	74	78	72	70	74	78	70	64	52	72	77	60	73	72	67	54	58	44	50	48	54	58	68	66.0
Richland	67	64	64	80	78	78	78	74	72	72	74	70	78	69	68	60	78	75	66	65	65	56	54	52	42	51	50	52	50	64	65.5
Rock Rapids	54	57	66	69	75	75	74	71	74	73	76	72	78	65	54	59	58	68	52	68	66	58	52	51	47	43	44	56	52	52	61.8
Seymour	66	54	64	76	73	77	76	78	72	68	71	71	77	76	70	57	68	76	69	68	77	69	55	54	44	52	54	51	54	65	66.1
Sibley	58	56	68	68	72	73	72	72	74	72	66	70	74	65	58	51	68	58	70	73	70	55	48	42	36	42	43	47	48	59	60.9
Sioux City	66	60	74	74	74	80	79	76	78	78	69	75	78	69	62	55	74	73	59	66	68	60	52	58	43	52	48	54	55	64	65.7
Storm Lake	65	62	64	76	75	77	78	77	78	76	70	72	75	71	66	59	68	78	72	68	74	62	55	72	42	54	48	51	55	61	66.7
Tipton	61	61	70	76	72	80	76	69	70	72	72	70	76	75	65	63	70	67	69	64	68	62	54	45	44	53	52	54	50	62	64.8
Villisca	57	56	65	70	71	70	72	72	70	66	70	68	70	70	56	52	72	68	65	68	68	58	56	50	44	52	54	53	60	68	63.2
Vinton	63	58	68	70	72	75	80	73	69	68	69	71	76	72	62	54	74	74	63	65	80	56	49	50	40	46	46	50	48	61	63.3
Washington	68	64	72	78	78	80	80	79	76	74	78	76	77	77	72	62	77	74	71	68	76	62	58	51	45	55	55	54	50	66	68.4
Webster City	62	55	60	69	72	72	75	75	74	76	76	76	78	70	68	63	76	76	62	73	78	66	54	53	42	46	46	56	51	63	65.4
Williams	....	58	68	69	72	71	72	72	72	68	68	66	70	66	58	54	71	71	64	66	64	54	47	47	41	49	42	48	48	62	61.4
Winterset	66	58	67	76	74	78	80	76	75	70	71	72	77	74	71	57	70	78	64	68	80	62	54	58	44	50	52	52	52	62	66.3

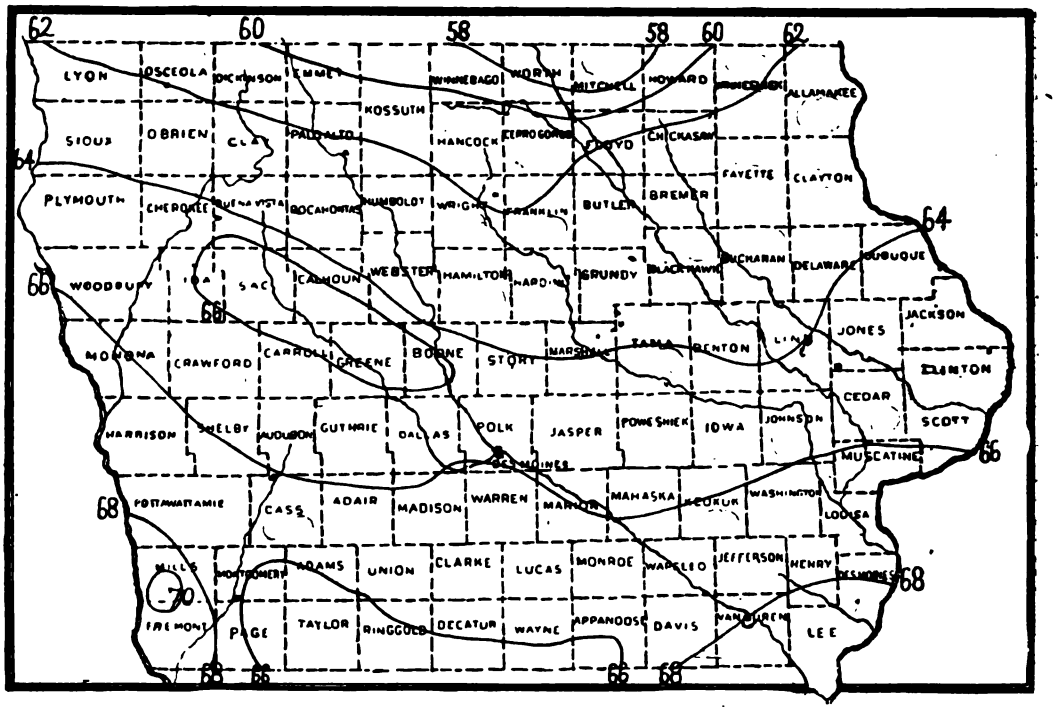
DAILY AND MONTHLY PRECIPITATION FOR SEPTEMBER, 1893.

STATIONS.	DATE. 1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	Total.
Algona																					0.70								1.20		1.90
Alta																		0.04	T	0.14									0.80	0.04	1.02
Ames (W. R. Cooper)																		0.07											1.80		1.87
Ames (W. H. Heilman)																		0.06		0.24									1.44	0.14	1.88
Ames (four miles southwest of)																		0.01	0.20	T									1.65		1.86
Amana																		0.22		0.50	0.08	0.01							0.48	1.34	2.63
Audubon																				0.06									1.42		1.48
Belle Plaine																		0.09		0.23	0.19								1.45		1.96
Blakeville																		T		0.58	0.27										0.85
Bonaparte																				0.86	2.00	0.56	0.14						1.49	0.08	5.13
Carroll																				0.15										1.21	1.36
Cedar Falls																		0.25		0.25	1.10	0.14								1.15	1.75
Cedar Rapids															T					0.18	0.42								T	2.25	2.85
Centerville																				0.90	1.00								2.30		4.20
Charles City	T																0.01	0.03		0.34	0.30								0.95	0.14	1.77
Clarinda																		0.04		0.17				0.15					1.98	0.04	2.38
Clinton																		0.25		0.08	1.57	0.12		0.05						2.18	4.25
College Springs																				0.43		0.61				0.19			2.06		3.29
Corning																		T		0.18		0.12							1.33	0.07	1.70
Cresco																		0.02			0.88								1.18		2.08
Davenport												T			T			0.10		0.17	1.02	0.04	0.02	0.15					1.19	0.67	3.36
Decorah																		0.06			0.28								.81		1.15
Delaware																		0.20		0.52	0.22								1.40	0.05	2.39
Des Moines																		0.01		0.19	T			T					1.11	0.02	1.33
Des Moines (5½ miles southeast of)								T												0.34									1.84		2.18
Dubuque															T			0.10		0.06	0.84								1.18	1.13	3.31
Elkader																	T	0.03		0.35	0.65								0.92	0.13	1.48
Ft. Madison																			1.31	0.32	1.00	0.45		24							1.56	4.88
Fulton																		0.05			0.05									1.04	1.14
Galva																		0.20		0.29	0.04								0.95		1.48
Glenwood																							0.03							1.32	1.35
Grand Meadow																	T	0.10		0.76									1.15		2.01
Greenfield																	T	T	0.68		T		0.04			T			2.69	0.11	2.92
Grinnell																		0.23		0.20	0.15								1.80		2.38
Grundy Center																		0.02		0.09	0.05								1.34		1.50
Hampton	0.05																T	T		0.09	0.20								0.95	0.25	1.54
Hopeville											T						T	0.08		0.82	T	0.39	T	0 03					1.95		3.27
Hopkinton																		0.15		0.25	0.95								1.75	0.20	3.30
Humboldt																					0.30								0 60	0.02	0.92
Independence																	T	T		T	0.15								0.80	0.20	1.15
Indianola																		0.12		0.33	T	0.04	T	0.05					0.18	0.45	2.76
Iowa City													T					0.23		0.36	0.07	0.23		0.08						2.10	3.07
Iowa Falls																		0.04		0.20									1.20		1.44
Jefferson																	T	T		0.35	0.08								1:00	0 15	1.58
Knoxville																		0 12		0.32	T	0 39		0.03					1.61	0.20	2.67
Keokuk										T								T	T	0.38	0.06	0.72	0.74	0.08					0.87	0.33	3.18
Keosauqua												T						T		1.25	0.34	1.44	0.58	0.15					1.10	0.54	5.40
La Crosse (Wis)																	0.04	T		T	0.81			T					0.29	0.15	1.28
Le Claire																		0.14	0.07	0.13		0.91	0.03	0.04						2.01	3.33
Larrabee																T	T		0.28											0.96	1.24
Logan																	0.02		0.28										1.20	0.13	1.35
Maquoketa															T			0.58		0.12	0.12									2.40	3.22
Mason City	0.02																0.02			0.38									1.40		1.82
Maxon																		0 10		0 63	T	0.65		0.09					1.64		3.11
Mechanicsville															0.01			0.44		0.21	0.10	0.01							1.94	0 06	2.77
Monticello																		0.09		0.19	0.17								1.39	0.66	2.50
Murray																		0 14		0.37		0.28							2.33	0.25	3.37
Newton																		0.08		0.28									1.75		2.11
Omaha (Neb)																	T	T		T	T		T	0.03					1.64	0.05	1.72
Osage																	T			0.01	0.45								0.20	1.15	1.81
Oskaloosa																		0.12		0.50	T	0.44	T							1.31	2.37
Ovid																		0.10		0.57		0.93							1.70		3.30
Panama																		0.01			0.05								1.29		1.35
Richland																		0.22		1.39	1.07	0.57		0.04						2.01	5.30
Rock Rapids									T						T														0.74		0.74
Seymour																		2.06		0.77		0.63	1.78	0.09					1.96		5.49
Sibley								T													T								0 82	0 06	0.88
Sioux City																					0.01					T			1.09	0 04	1.11
Spirit Lake																				0.34									0.74	0.06	1.14
Storm Lake																	T			0.15	0.03								0.58	0.14	0.85
Tipton													T					0.36		0.11	0.20	0.21		T					2.51	T	3.39
Villisca																		0.01		0.18		0.13						0.00	0.77		1.92
Vinton																				0.42	0.06								1.37	T	1.85
Washington																		0.18	0.58	0.10		1.15	0.40							1.83	4.24
Webster City																				T	T										

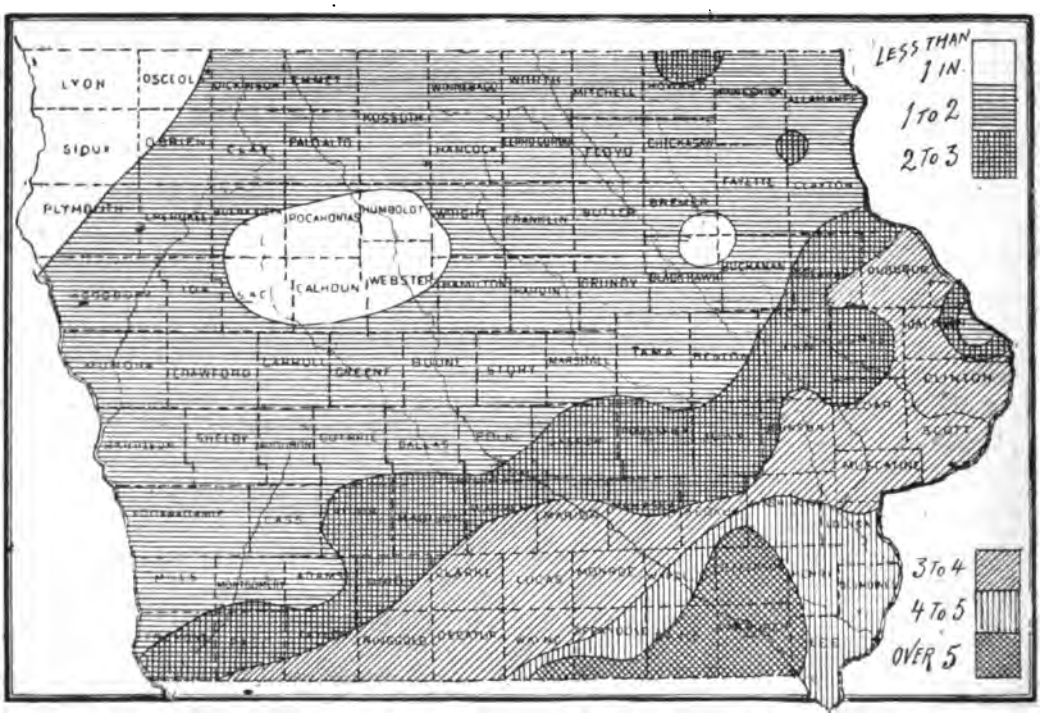
MAXIMUM AND MINIMUM TEMPERATURE FOR SEPTEMBER, 1893.

| STATIONS. | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | | 9 | | 10 | | 11 | | 12 | | 13 | | 14 | | 15 | | 16 | | 17 | | 18 | | 19 | | 20 | | 21 | | 22 | | 23 | | 24 | | 25 | | 26 | | 27 | | 28 | | 29 | | 30 | | Mon'y Mean. | |
|---|---|---

MEAN TEMPERATURE SEPTEMBER 1893.



IOWA PRECIPITATION CHART SEPTEMBER 1893.



METEOROLOGICAL STATIONS AND OBSERVERS.

From the following, weekly and monthly reports of Meteorological data are received by the Iowa Weather and Crop Service.

Albia	Gus Johnson.
Algona	C. D. Pettibone.
Alta	D. E. Hadden.
Amana	Conrad Schadt.
Ames	E. C. Dickinson.
Ames	W. H. Heileman.
Ames, (4 miles S. W.)	Isaac Young
Atlantic	J. W. Love.
Audubon	J. F. Hocker.
Belle Plaine	H. W. Vandike.
Blakeville	James Rodgers.
Blockton	C. W. Thompson.
Bonaparte	Hon. B. R. Vale.
Carroll	Moses Simon.
Cedar Falls	Prof. A. C. Page.
Cedar Rapids	H. D. Olds.
Centerville	Prof. R E. Reister.
Charles City	J. W. Smith.
Clarinda	A. S. Van Sandt.
Clinton	Luke Roberts.
College Springs	A. A. Berry.
Corning	John W. Bixby.
Cresco	Gregory Marshall.
Council Bluffs	E. W. Hart.
Davenport	*F. J. Walz.
Delaware	Wm. Ball.
Decorah	L. H. Baker.
Denison	P. H. Schlumberger.
Des Moines	*Geo. M. Chappel, M. D.
Dubuque	*S. C. Emery.
Eagle Grove	C. A. Schaffter.
Eldora	Prof. C. F. Woodward.
Elkader	Chas. Reinecke.
Emmetsburg	H. Conroy.
Fairfield	J. Fred Clarke, M. D.
Fayette	R. Z. Latimer.
Ft. Madison	Miss L. A. McCready.
Calva	W. A. Crowley.
Glenwood	Seth Dean.
Greenfield	J. G. Culver.
Grinnell	Prof. S. J. Buck.
Grundy Center	Chas. G. Rogers.
Hampton	E. C. Grenelle.
Hawkeye	J. W. Bopp.
Hopeville	M. T. Ashley.
Hopkinton	Theo. Marks
Humboldt	J. W. Foster.
Independence	E. F. Wulfke.
Indianola	Prof. J. L. Tilton.
Iowa City	Prof. A. L. Arner.
Iowa Falls	J. B. Parmelee.
Jefferson	Dr. Chas. Enfield.
Keokuk	* Fred. Z. Gosewisch.
Keosauqua	Prof. J. H. Landes.
Larrabee	H. B. Strever.
Logan	Mrs. M. B. Stern.
Mason City	H. I. Smith.
Marshalltown	L. S. Kilborn.
Maquoketa	Dr. A. B. Bowen.
Mechanicsville	Rev. J. W. Hubbard.
Mooar	F. G. Thomas
Monticello	Henry D. Smith
Mount Vernon	Prof. A. Collin.
Mt. Ayr	Hon. Wm. Shriver.
Murray	A. W. Lewis.
Muscatine	J. P. Walton
Newton	A. Lufkin
Omaha, Neb	*Geo. E. Hunt.
Ovid	H. C. Miller.
Osage	G. D. Pattingill
Oskaloosa	Jos. Boyd.
Panama	Wm. J. Wicks.
Postville	F. L. Williams.
Richland	Wm. A Shaffer.
Rock Rapids	W. C. Wyckoff.
Seymour	Mrs. C. A. Conger.
Sibley	H. G. Doolittle.
Sidney	G. V. Swearingen.
Sioux City	*U. G. Pursell
Sac City	Dr. C. Brown.
Spirit Lake	H. C. Drummond.
Storm Lake	A. J. Bond.
Tipton	J. M. Rider.
Vinton	T. F. McCune.
Villisca	Hon. J. S. Boise
Washington	Wm. A. Cook.
Webster City	C. M. Trumbauer.
Winterset	Will McKnight.
West Bend	Phil. Dorweiler
Williams	M. L. Fuller.

*U. S. Weather Bureau.

WEATHER-CROP OBSERVERS.

Reporting for the Weekly Bulletin.

Afton	M. V. Ashby.
Agency	J. H. Van Zant.
Albia	Wm. Mercer.
Alta	Hon. H. T. Saberson.
Ames	Henry C. Wallace.
Anita	H. T. Chapin.
Ankeny	Ed. Parmenter.
Battle Creek	A. Preston.
Bloomfield	Geo. Duffield.
Boone	L. C. Morris.
Carbon	N. M. King.
Carson	G. N. Ferguson.
Centerville	Henry Galley.
Charles City	W. B. Towner.
Chariton	C. C. Burr.
Clarksville	F. M. Russell.
Corning	Jerome Smith.
Clermont	Chas. Larrabee.
Concord	J. M. Elder.
Council Bluffs	L Prouty.
Dedham	J. W. Kay
Danville	Sherman Matthews.
Emerson	D. B. Nims.
Ely	Hon. A. J. Fuhrmeister.
Fontanelle	W. H. Bridgman.
Ford	W. W. Whitmore.
Fort Dodge	R. W. Blaine.
Geneva	Wm. H. Thompson.
Gosport	B. F. Banta.
Grand River	Dr. John Davkin.
Grinnell	A. O Price.
Harlan	Fred Fischer
Hesper	G. E. Dillingham.
Hodge	James Piper.
Hamlin	F. P. Moore.
Humeston	Hon. S. H. Moore.
Independence	C. L. Thomas.
Indianola	T. B. Hammer.
Jefferson	S. M. Taylor.
Larrabee	H. H. Carnahan.
LeMars	Hon. Henry Schrooten.
Ledyard	Frank Miller.
Lawler	Hon. Wm. Glattly.
Lockridge	John F. Farman.
Manning	H. W. Pollock.
Mapleton	A. Lamb.
Marshalltown	Hon. J. G. Brown.
Mason City	Wm. Nettleton
Mt. Pleasant	W. S. Wright.
Milton	Hon E. C. Holland.
Mount Vernon	Robert Smith.
Newton	J. P. Beatty
North English	J. L. Williams.
Nevada	O. G. Ashford.
Osage	E. W. Stacy.
Orange City	H. J. VandeWaa.
Paton	Hon. Joshua Jester.
Pittsburg	G. C. Duffield.
Polo Station	A. E. Miller.
Prescott	G. W. Iden
Paullina	Geo. Hakeman.
Rockwell City	J. G. Palmer.
Rock Rapids	D. E F. Merrill.
Rossville	F. B. Wiley
Sandusky	Z. Hollingsworth
Sageville	Hon. F. N. Knoll.
Shenandoah	Reuben Mullison.
State Center	E. N. Thompson.
Sumner	John Dawson.
Tama	W. G. Malin.
Van Horn	Spencer Smith.
Wapello	O. P. Smith.
Waukee	John Wragg
Wheatland	D. Beckman.
Willow Creek	W. S. Nicholson
Winterset	H A. Kinsman
Wall Lake	F. E. Wilcox
Walnut	F. L. Martin
What Cheer	O. D. Lawrence.

UNITED STATES DEPARTMENT OF AGRICULTURE

WEATHER BUREAU.

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MONTHLY REVIEW

OF THE

J. R. Sage,
Des Moines.

Iowa Weather and Crop Serv

VOL. IV.—OCTOBER, 1893.—NO. 10.

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CENTRAL STATION, DES MOINES, IOWA.

J. R. SAGE,
DIRECT

GEO. M. CHAPPEL, M. D.,
LOCAL FORECAST OFFICIAL,
U. S. WEATHER BUREAU, ASS'T DIRECTOR.

DES MOINES:
G. H. RAGSDALE, STATE PRINTER.
1893.

THE IOWA WEATHER AND CROP SERVICE.

Was established by act of the Twenty-Third General Assembly, and placed under supervision of the Board of Directors of the State Agricultural Society, constituted as follows:

OFFICERS.

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Vice-President—John A. Evans, West Liberty, Muscatine Co.
Secretary—John R. Shaffer, Des Moines, Polk Co.
Treasurer—C. B. Worthington, Des Moines, Polk Co.

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J. W. McMullin. John A. Evans, John R. Shaffer.

U. S. Department of Agriculture---Weather Bureau.

MONTHLY REVIEW

OF THE

IOWA WEATHER AND CROP SERVICE.

VOL. IV.] OCTOBER, 1893. [NO. 10.

EDITORIAL NOTES.

The Agricultural College boys took the first premium on cheese at the Iowa State Fair. That dairy school at Ames is doing admirable work.

***

The wise farmer makes ample preparation for a severe winter; then if it proves mild he is none the less fortunate. It is safe in this climate to count on some hard storms in the winter months.

***

An important feature of fall work is the plowing, of which there was never more done than this year in the northwest. The advantage of fall plowing is now fully realized, and the farmers have employed all the shining hours of this splendid autumn. It means a great advantage in next year's campaign on the farms of this section. From seed time to harvest this year has been a grand one for northwestern farmers. There have been seasons of greater yield of some particular crop, but there has rarely been a better yield of all crops, better in both amount and quality.—*Sioux City Journal.*

***

It is said chinchbug infection is equally fatal to the striped pests which so greedily devour squash and cucumber vines. If that is true it's a good thing to pass around.

***

Chamberlain, S. D., has an artesian well eight inches in diameter and 670 feet deep, from which a stream flows of sufficient volume to run a 150-barrel roller mill and an electric light plant. After the flow was struck the drill appeared to go through a subterranean lake sixty feet in depth.

***

The relief committee appointed at the time of the Pomeroy tornado has made its final report. It shows a total of seventy-one deaths from the storm. Forty-nine were in Pomeroy, six in Buena Vista county, twelve in Cherokee county, and four in Calhoun county outside of Pomeroy. All needy are reported amply cared for, and no further relief is necessary. In all $69,761 in cash was contributed, besides lumber, brick, etc. The committee restored exactly 100 homes and furnished complete relief to 150 families made homeless. The total property loss is finally placed at $250,000.

***

Dr. Kassner has recently written a pamphlet on the statistics of lightning strokes in Germany. From his tables, based on reports of fire insurance companies, it appears that in eight years the number of lightning strokes in Germany increased 72 per cent. About one-third of the strokes tabulated occurred in July. Southern Germany has its maximum in June, while central Germany has its maximum in May.

***

It is gratifying to learn that Iowa had the largest and best exhibit of apples at the World's Fair, having 200 varieties more than any state or country.

***

The report of the Kansas Board of Agriculture for the month of September, reports the total area sown in wheat last Autumn to have been 4,909,972 acres; acres harvested, 2,617,694. The yield per acre averaged 9¼ bushels. The total area of corn planted this year was 6,227,067 acres. Acres reported worth harvesting, 4,621,162; and total probable product, 113,585,652 bushels. The area of oats harvested was 1,758,127 acres; average per acre, 16.03 bushels.

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October was a remarkably clear and pleasant month. At the Central Station the government sunshine recorder showed a total of 254 hours, or 74 per cent of the number of hours of possible sunshine.

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The November returns to the department of agriculture on the rates of yield per acre makes the averages for corn 22.6 bushels. The result is due in main to the severe, extensive and persistent drouth. The rates of yield in the principal corn states are reported as follows: New York, 29.3; Pennsylvania, 24.9; Ohio, 24.8; Michigan, 23.7; Indiana, 24.3; Illinois, 25.5; Iowa, 35.4; Missouri, 27.5; Kansas, 20.3; Nebraska, 25. The October report placed

the condition of corn in Iowa at 93 per cent, or below an average yield. The November estimate of yield per acre credits this State with an average product of 35.4 bushels per acre, which is 2.4 bushels above the average of the past fifteen years.

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A new meteorological station has been established at Rockwell City, with Prof. G. B. Rigg as observer. Mr. Rigg has been supplied with a rain gauge and it is the intention of this office to equip him with thermometers also, in a short time, making Rockwell City a regular station.

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The worst climate for persons affected with a nervous dread of lightning is the east coast of San Domingo, where the sky at the beginning of the rainy season is often illuminated for weeks by nearly continuous electric twinkles and flashes. In western California, on the other hand, the equilibrium of atmospheric electricity is so rarely disturbed that many old residents of San Francisco have never heard a good thunder peal of the traditional, window-shaking kind.—*Ex.*

ON THE PRODUCTION OF RAIN.

PROF. CLEVELAND ABBE IN AGRICULTURAL SCIENCE.

The great interest that has been excited throughout the world in the question as to whether or not the progress of science gives us as yet any hope that man may cause rain to fall in times of drouth, or to cease falling in times of flood, renders it proper that a brief sketch should be given of some, at least, of the many methods that have been suggested as a means of accomplishing this end. Although none of these methods have any practical value, still it is important to briefly summarize the results of experience if only as a means of saving present and future generations from an unnecessary waste of money. It is, on the other hand, equally important after divesting ourselves of erroneous views, to seek for such light on the subject as our limited knowledge affords, and to mark out such further lines of investigation as may elucidate this difficult but important problem.

Although the production of rain is undoubtedly a purely material, physical process, and should be studied by the methods of modern science, yet it is impossible not to recognize that there has always been a certain supernatural aspect to the question, and that probably the majority of mankind, at the present moment, take that view of it. In fact, the importance of rain to human existence has, from time immemorial, led mankind to seek some method by which to secure it when needed. Divinations and incantations, prayers and sacrifices, the fetish of Africa and the gapogari of India illustrate respectively what may be called the superstitious and the theological theories on the subject of man's influence upon the weather. The recent progress of meteorological science has led us, on the one hand, to properly evaluate supernatural methods, and, on the other hand, to query as to whether there really is any material physical principle that we can call to our aid in order to make it rain or cease raining. The following paragraphs may therefore illustrate such methods as have been suggested or tried:

1. Before the use of cannon the church bells were rung vigorously in order to dissipate dangerous storms. Parent states that in 1703 the inhabitants of Iliers, by ringing the bells, forced a hailstorm to break in two and thus saved their fields. It would appear that originally this practice was suggested by the idea that the ringing of the bell called the people to prayer, and that, in fact, the bell represented the voice and prayers of the church, but eventually the theory was advanced by Le Maout (at Le Brieuc in 1854) that the sound, namely the concussion in the air, produced by the bell, in some way caused the clouds to drop rain.

2. It is well known that it has long been the practice among sailors to discharge a cannon at a water-spout, hoping that it can be thus broken up before reaching the ship. Mr. R. de C. Ward (*Am. Met. Jour.*, March, 1892) states that in the memoirs of Benvenuto Cellini there is mention of the fact that an impending rain storm was averted in the year 1539, at Rome by firing off artillery in the direction of the clouds, which had already begun to drop their moisture. Arago says that as early as 1769 it was the practice to fire guns to break up a storm, but he shows by weather records that such firing has no such effect. The Swiss peasants discharge firearms into the clouds to draw off the rain before lightning and hail can form. The idea was that quiet air produced large hail, but that when disturbed by noise it could only produce small hail and rain—just as a crystallizing solution gives large crystals the more quiet it is. Patricius Heinrich in a prize essay published by the Bavarian Academy, in 1785, showed that cannonading does not prevent hail, and, in fact, has no appreciable influence on the clouds. Kaemtz (in 1831) quoted the case of 36,000 soldiers who fired a salute in order to break up an approaching thunder-storm during their evolutions, but failed. Denize and Parrot maintained that the vapor and smoke of gunpowder exerts a chemical influence unfavorable to thunder-storms and thus prevents them.

3. In opposition to the preceding, the idea has been frequently defended, during the past century, that the violent concussion produced by the explosion of gunpowder caused the minute particles in the clouds to jostle together and fall as rain. The earliest one to advance this idea, so far as I can find, was J. C. Lewis, of Washington, in 1825, but its most prominent advocate since 1870 has been Mr. Edward Powers. On this principle, in 1854, Le Maout, from the rainfalls in western France, predicted that an important battle must be in progress in the Crimea, which, in fact, he subsequently identified as the cannonading at the battle of Inkerman an hour before his predictions. The ideas advocated in this country by Mr. Powers, and in England by Mr. R. D. Belcher, in 1874, received a qualified adherence from Prof. J. K. Laughton, Prof. Elias Loomis and Prof. J. D. Everett, although these distinctly disclaim their approval of the arguments used by Powers and Belcher. Mr. H. C. Russell, of Sidney,

Australia, has strongly combatted both the arguments and the ideas. At present this concussion theory certainly has not the support of any prominent physicist.

4. The hypothesis that electrification keeps the particles of a cloud apart, and that its sudden removal by the discharge of lightning directly causes hail, and heavy rains or cloud bursts, was promulgated soon after Franklin's experiments with his electric kite. Montbeillard, of Dijon, in 1776, held that hail would be impossible if the electricity were drawn early and quietly from the clouds; hence followed attempts to quietly discharge electrified clouds by means of lightning rods or wires carried up by kites, or even by captive balloons, in the hope that the formation of destructive hail or rain would be prevented. P. Heinrich, in his prize essay above referred to, Wrede and Wien in 1800, and many since then, have shown by statistics that fields of grain thus protected by lightning rods suffer from the hail, rain and wind quite as much as the neighboring fields without protection. The rods do not appreciably diminish the number and intensity of destructive discharges of lightning, but when they receive the discharges they save the buildings and the harvested crops from destruction by fire; the rods have no influence on the rain and hail. According to Volta large hailstones are formed from smaller ones that are alternately attracted and repelled between two parallel layers of clouds; the surfaces of the hailstones are cooled by the evaporation of the added water. Volta expressly demonstrates that the electric condition of these clouds cannot be affected by lightning rods.

5. It has been thought that, by setting fire to heaps of brushwood, a destructive storm with its lightning and hail, can be averted; but Volta, the advocate of this method of depriving the cloud of its electricity, after a first few years of success on the Roman Campagna found that his experience was the same as that of his neighbors, and that no effect was produced. P. Heinrich, in his prize essay, also shows the uselessness of such fires. Piccard compared the data for twenty-five years as to fires and rainy days in Switzerland, but found it demonstrable that there was no connection between them. Prof. John Trowbridge, in 1872, showed how a slight possible connection might exist that is worthy of further study.

6. The electrical condition of a moist atmosphere seems likely to have some relation to the formation of raindrops, but our knowledge on this subject is very meagre. Most students agree with Kaemtz, who, in 1831, said that we know not which is cause and which is effect, but that most probably the lightning is the result of the formation of cloud and rain. Prof. John Trowbridge in his experiments, above referred to, showed that flames from fires tend, like lightning rods, to reduce the positive electrification ordinarily observed, to a neutral or even to a negative condition. Ordinary observations of atmospheric electricity show that cold, polar winds bring an increase of positive electric tension. In general a positive condition exists in the air in or around a snowstorm, but rapid changes are the result rather than that they are the cause of the precipitation or of the winds or temperature.

In 1880 Mr. Ruggles advanced the idea that "by altering the electrical condition of the upper air and the electrical force that controls the atmosphere" he could govern the formation and movements of rain-clouds and thunderstorms, but no adequate means to accomplish such alteration has been devised.

7. A number of interesting laboratory experiments by Rayleigh and others (see Guthrie on "Soap Bubbles") have shown that by electrifying a fine jet of water we may prevent it from breaking up into separate drops. These results are apparently produced by changes of the surface tension of the drops; the electrified drops coalesce when they strike each other, whereas drops of pure water unelectrified rebound and remain separate. Hence follows the idea that by thus electrifying a cloud we may cause the suspended small drops to unite into a steady downpour of rain, but no means has yet been found to accomplish this end. Possibly this idea is equivalent to that present in the minds of those who advocate making it rain (see J. R. Buchanan, 1891,) by drawing the electricity from the clouds.

8. Having given up the idea that rain and hail are due to the sudden removal of an intense electrification, such as precedes the discharge of lightning, some theorists reverted to the idea that it is the noise of the thunder attending the lightning that produces a concussion within the cloud, and that this is nature's method of jostling the cloud particles together into larger drops of rain. This is an advance on the idea that noises made by mankind, such as bell-ringing or cannonading, can cause rain; but it is equally contradicted by ordinary observation which shows that there is no necessary connection between thunder and rain. On this whole question of the effect of concussion, namely the rapid vibration of sound, it may be remarked that Champion and Pellet, in 1873, succeeded in inducing the explosion of dry iodide of nitrogen by the high-pitched notes of the Chinese tom-toms and by the explosion of a very little nitro-glycerine, but not by the noise made by the explosion of ordinary gunpowder. It has not yet been shown, however, whether the result was caused by the sympathetic vibration of the molecules of these chemicals responding to the high-pitched note, or whether it was due to the small masses of the chemicals rubbing against each other and the anvil on which they rested, both being set into sympathetic vibrations with the string of the violin. The latter is more probable, but neither case would afford ground for supposing that cloud particles, which are relatively far apart, could be brought to coalesce by this process. The experimental firing of a pistol or gun into a cloud of fog or steam produces no appreciably agglomerations of the globules of water.

9. The advocates of the theory that great battles are followed by rain, not content with maintaining the influence of great noise in producing rain, have also gone to the extreme of maintaining that the heat of the conflict and the moisture from the breath and the perspiration of many men has an appreciable influence in producing the subsequent rain. In general, however, it does not appear

that rain is any more likely to follow a battle, great or small, than it is to occur without a battle.

10. About a hundred years ago Hutton advocated the idea that rain is naturally formed by mixing warm, moist air with colder moist air; this idea has long since been dispelled, as it has been shown that by mixture alone we can produce only a haze of fog, but not a rain; nevertheless it has been lately proposed to produce rain artificially by this method of mixture. Mr. G. H. Bell proposed to erect a tall tower, which might also serve for other purposes and through which warm air is to be sent up into the upper regions and mixed with the cold, moist air above, producing a local rain in the immediate neighborhood whenever desired. This inventor also proposed, when need be, to reverse the motion of the fan, thereby bringing the clouds down to the earth and preventing rain. A similar idea is advocated by Mr. James W. Pitkin, of Kansas City, who would have a large sheet of canvas held up by balloons so that a horizontal wind striking against it will be deflected upward precisely as when blowing against a mountain side. Mr. Pitkin also proposes to support large canvas tubes by means of balloons, the cold air to be drawn down a long tube and driven up through a short tube until it can be delivered at the proper elevation in the atmosphere.

These ideas of Pitkin and Bell must utterly fail of their object because of the mechanical impossibilities as well as because of the erroneous principle on which it was proposed to make rain.

11. The idea that an extensive fire may, under certain circumstances, determine the formation of cloud and rain was maintained by Espy as a necessary consequence of his theory of the cooling by expansion of rising air. In fact, numerous examples are at hand to show that when the air is very moist a large fire may initiate a rising current of air and a cloud that shall grow into a local rainstorm; the fire is simply the initiative and determines where the cloud will start; it can hardly be said to cause the rain, nor does it decide, in any case, where the rain will fall; it simply performs the same office that the pulling of a trigger does for the discharge of a gun and the fall of a distant bird; or that an act of the will does for our physiological muscular machinery.

Prof. Espy's ideas have been widely supported, and the fact that rain cannot be started by an artificial fire when the air is very dry is really a further confirmation of the views expressed by him. Prof. J. K. Laughton, in England, and Mr. H. C. Russell, of Sidney, New South Wales, have shown how rarely the bush fires of Australia are followed by rain owing to the dryness of the climate; in general, when the winds are blowing up over a mountain range, plenty of rain falls and usually without lightning, so that we have no reason to invoke the aid of electricity, noise, smoke or fire. The power contained in the sunshine that is received on a single acre of ground, when the sun is near the zenith, is greater than that exerted by a steam engine of 4,000 horse power; when this power is exerted to heat the air and cause it to rise it is fully equal to the work of lifting 60 tons of moist air 1,000 feet high per minute.

12. The experiments of many physicists have shown that certain solids have the power of attracting around themselves a condensed atmosphere of one or more gases; especially is this true of carbon, so that the fine particles that constitute smoke and soot may be conceived of as surrounded by dense atmospheres of aqueous vapor. These nuclei being good radiators of heat are supposed to become especially cooled and to condense the vapor upon themselves, so that they may become the nuclei of cloud particles. Then these dust particles, whether they result from forest fires or the spray of the ocean, the pollen of plants, the dust of the highway or the consumption of shooting stars, may be an essential feature in the formation of rain or snow. Therefore any process that increases the quantity of dust in the air contributes to the formation of rain, and in fact visible drops of vapor are not easily formed, even by cooling the air below its dewpoint, unless dust nuclei be present; this is made the basis of Aitken's method for determining the number of particles of dust in the air. Prof. Blake, of Kansas University, proposes to make rain by distributing fine dust in the atmosphere, but human agency cannot economically increase the percentage of dust already in the cloud region.

13. The idea has been promulgated that possibly there exists some gas or vapor or other substance that, like smoke, can be injected into the air and that will initiate the condensation of the aqueous vapor. This is the method claimed by Mr. Frank Melbourne, but the chemicals used by him are kept a secret, and other parties having adopted the same idea appear to be using chemicals different from Melbourne's. The general method of procedure seems to be that the operator, within a building, makes the gas in secret, and it is seen escaping from a a chimney, while an assistant circulates among the spectators outside and takes their bets as to the success of the operation. There is no principle known to chemists that would justify us in expecting this method to succeed in producing rain, and actual experience shows that the failures have been quite as numerous as the successes, just as would be the case if the chemicals had nothing to do with the rain.

14. The explosion of balloons, filled with a mixture of oxygen and hydrogen, produces a small quantity of aqueous vapor, which is at first hot and expanded, but in a few moments becomes cool and condensed. Dyrenforth advances the theory that these few particles of nascent water serve as natural nuclei, attracting to themselves the aqueous vapor already in the atmosphere resulting in the formation of mist, cloud and rain. No successful experiment of this kind has ever yet demonstrated the truth of this ingenious theory. Evidently the great heat produced by the chemical combination of oxygen and hydrogen must, in some way, be got rid of before the surrounding aqueous vapor can condense into drops.

15. Man may not hope to assist nature in the formation or prevention of rain until he better understands the details of nature's own methods. The ideas most widely accepted, at present, as to the natural process of the formation of rain, go only so far as to say that the moisture

present in the atmosphere is extracted from the air by three different steps, namely, first, the saturation with aqueous vapor that is produced by cooling the air; second, the condensation of the vapor into small visible particles of cloud and fog; third, the agglomeration of these droplets of water into drops large enough to be precipitated as falling rain, hail or snow.

I. The ordinary natural methods of accomplishing the cooling required in the first of these steps are: (a) the mixing of cold and warm air by which, however, only a very slight amount of precipitation can be formed; (b) the radiation of heat to the colder earth and air and space by which at first thin layers of fog or stratus clouds are formed, which then slowly thicken with time; (c) the rise and expansion of large masses of air; the mechanical work done by the expansion simultaneously of the whole mass may cool it to any extent whatever. This last is the important process on which all our rain depends.

II. The second step, namely condensation, is a molecular process that has been likened to the crystallization of solid salts from liquid solutions, although there is too little known about either process to warrant the belief that they are really similar. Aitken and others maintain that the condensation of vapor, like the crystallization of salts, demands some nucleus as a starting point, and that every minute droplet of fog or cloud must have a particle of atmospheric dust as its initiative.

III. The third step in the above process of rain formation is the agglomeration of fog or cloud particles into larger drops. About this there is very little known from actual observation, and the hypotheses are quite various. The hypothesis that among these particles some are larger than others, and, by their more rapid descent, overtake the smaller ones, and thus grow larger as they descend, seems at first quite natural, and is sufficient to explain the fact that the quantity of rainfall is an exceedingly small percentage of the water that is visible as a cloud and, of course, a still smaller percentage of the water that is present as vapor in the air. On the other hand, a microscopic observation of the sizes of the particles of fogs do not show a variation in the diameters sufficient to allow of one of the particles falling much faster than its neighbor; therefore as the air always has a motion sufficient to carry these minute particles along with it, it would seem that if they are to come into contact and form larger particles it must be through a process of jostling together rather than through a process of falling by gravity.

But the contact of two particles, whether by gravitational fall or by the jostling of wind-currents, will not necessarily cause their union; it is essential that the surface tensions of the two particles be properly adjusted to each other, and this latter point seems to demand further study. It is true that by proper electrification we are able, in the laboratory, to alter the surface tensions and to cause small fog particles to coalesce, but it is not so evident that this is the ordinary process of nature We are also able in the laboratory to alter surface tensions by surrounding the particles with a different gaseous or vaporous atmosphere, or even by changing the temperature of the particles; but neither of these processes is likely to be the process that takes place in the clouds. Rayleigh's experiments on jets of soapy water make it plausible that a slight impurity in the rain water, such as ammonia or nitric acid, may make it possible for certain cloud-particles to agglomerate, while the neighboring droplets of pure water ought not to do so. Again, a thin film of foreign substance, such as oil on the water, lowers the surface tension and allows two such oily drops to combine into one, when the film is broken at any point, by pressing the drops close together. But none of these laboratory experiments seem applicable to the formation of the natural cloud and rain.

16. As to the various hypotheses that have been suggested concerning the method by which the agglomeration of droplets into large drops is actually effected by nature in her regular process of making rain, I must remark that it is not yet clear to me that any one has demonstrated that small drops actually do agglomerate into larger ones to any considerable extent. I think it quite possible that the union of small cloud-particles into larger ones is only effective in driving fogs or clouds whose upper surfaces cool by radiation, but is, after all, not an important feature in the natural production of generous rains and summer thunder showers. It is a reasonable "working hypothesis" that the particles which were originally too small to fall from the clouds with any rapidity actually remain there entangled in the currents of air that characterize clouds, and that they are subsequently evaporated, while, on the other hand, only those fall as rain which originally had a size vastly larger than the average size of the smaller particles that constitute the major portion of a cloud. There may be some reason why the condensation of the superabundant molecules of a saturated vapor should form, not merely cloud-particles whose diameter is ordinarily less than one one-hundredth of an inch, but also, here and there, large drops which fall to the ground as rain with very much the same size as when originally formed a few moments before in the clouds. The sudden pour of heavy rain from a limited region within a thunder cloud cannot be due to a general slow progressive agglomeration of droplets into drops.

On this point I submit the following modification of ideas suggested by reading von Bezold's fourth paper on the "Thermodynamics of the Atmosphere," Berlin, 1892; it suggests a new point of view, and one that demands further experimental elucidation.

Bezold suggests that the heavy rains generally known as cloud-bursts are immediately preceded by, and may owe their origin to, a supersaturated state of the atmosphere, by reason of which a greater quantity of vapor is contained in the air than would, under other conditions, be possible at a given temperature. Following out this hypothesis, I conclude that, whatever molecular condition it be that permits the existence of a supersaturated atmosphere, it is evident that the removal, or annulment, of that condition must give rise to an immediate and heavy condensation. This principle may be extended to all ordinary rains as well as to the violent thunder showers and cloud-bursts.

The supersaturated condition must be considered as a case of adiabatic expansion[1] accompanied by a delay in the occurrence of the appropriate condensation. So far as we at present know this condition can occur only in those cases where all foreign substances, or dust-particles, are absent, which might serve as nuclei for the formation of fog-particles. A slowly rising and cooling atmosphere first condenses its moisture on the dust nuclei and forms minute droplets; these grow very slowly, by diffusion, up to a definite size proper to the prevailing temperature and vapor tension, but the intermediate air, in which these droplets are floating, keeps on cooling as a dust-free, supersaturated vapor. If the sun shines on these droplets its heat powerfully contributes to evaporate them and further saturates the surrounding air.

In general, therefore, the ascending portions of every cloud contain supersaturated, dust-free vapor separating the isolated droplets When by further expansion and cooling the supersaturation has proceeded to such an extent that further condensation must occur, this latter molecular change permeates the supersaturated space with a rapidity comparable to that with which any other chemical change takes place, just as when the explosive union of chlorine and hydrogen, or of oxygen and hydrogen, starting at any point, almost instantaneously permeates a mass of these mixed gases, or, as when combustion runs along a train of gunpowder. The vapor molecules from the supersaturated spaces are quickly brought together by their molecular attractions into heavy drops of warm water which are often distinct from the intermediate cooler droplets and descend rapidly from the clouds, while the latent heat of condensation is communicated to the adjoining air and is left behind in the cloud. Thus simultaneously with the formation and fall of the big drops there is a sudden expansion of the clouds from which they came. Bezold thinks that such expansion may possibly be felt at the earth's surface as a sudden rise in the barometer, while it is also visible to the eye as a sudden expansion of the cloud into the so-called "thunder-head." I myself doubt whether there would be any appreciable barometric result, yet I consider that the sudden expansion and ascent of the white cloud and its subsequent rapid dissipation into the surrounding air, together with the simultaneous lightning, thunder, rain, hail and ascending whirl of wind, all conspire to make it very plausible that there really existed a supersaturated condition at the moment immediately preceding.

If the temperature of the dew-point of the ascending air, or the temperature of supersaturation is below freezing, the condensation of the vapor may at once form, not drops, but large snowflakes, such as will fall rapidly to the ground, or the small hail that is ordinarily called sleet.

Correlated phenomena occur when a cloud consists of small particles of water cooled below the freezing-point, as is known to be frequently the case. When for any reason these particles are suddenly converted into ice, as will happen when they are cooled low enough or when they jostle against each other, their temperatures at once rise to the freezing-point, a large quantity of heat is set free, the cloud expands and rises and the droplets of water are converted into spiculæ of ice, or small snowflakes; large flakes and hailstones are not to be explained in this manner.

There is some plausibility in the hypothesis that the critical electrical condition, which results in lightning, is directly due to the disruption of the condition of extreme supersaturation and the sudden formation of large drops of water, or the disruption of the condition of the water cooled below the freezing-point and the consequent sudden formation of ice or snow, but this remains to be investigated.

Therefore, according to this latest view of the subject, the problem of the artificial formation of rain will be partially solved, and sufficiently so for practical purposes, if some method is invented by which to bring about a sudden formation of a small percentage of large drops out of the moist air that exists between the small particles of every cloud.

At present our attention and experiments should be directed toward understanding and completing the natural and obscure process involved in the formation of rain within the cloud and not toward the forcing of any unnatural process.

[1] *i. e.*, without adding or subtracting heat.

AUTUMN IN IOWA.

It may be foolish for people to make comparisons who have not personal knowledge of the things they compare, but it is a common and perhaps a harmless habit. Many of us are fond of saying that no country on earth can be more beautiful than northwest Iowa in autumn. We have not seen every country on earth, and we do not know, by the experience of our own eyes, what salubrity of climate, what delicacy of tints, what wealth of foliage, what blueness of sky there may be; but certainly it is an innocent fiction for us to say that ours is the loveliest of all. Experienced travelers say that the storied skies of Italy are not more beautiful than ours, and we are quick enough to believe it. We do know that in this land of bluff and prairie the autumn is the loveliest season of the year, and we know also that what the spring and summer are in perfection in other regions of our land the fall season is to Iowa and surrounding states. It is cloudy and showering to-day, but there is nothing in the autumn rains to dread. They do not saturate the chilly air and make it damp, muggy and disagreeable. They are welcomed as a benefit, and are generous in season. Through the cloudy day the warm recollection of Tuesday lingers, and we know that there are more beautiful days to come, and that they will extend clear into the time when winter has actually begun in other regions. The nights are cool and frosty, but the sun rises clear and warm in the morning and the day is glorious from dawn until long after the sun has sunk out of sight. All the day that brilliant luminary dispenses a cheerful warmth. The air is clear, dry and invigorating. The prairies and the hills, with the shading of rise and hollow, give innumerable tints of brown and gold, with a suggestion of green, like

changeable silk. The sky is indescribably blue, often without the suspicion of even the whitest cloud, from zenith to horizon. From the bluffs we can see the panorama stretched out for thirty miles or more, and it only ends with the range of human eyesight and the curvature of the earth. It does not fade away, curtained in a cloud of haze, but diminishes in perspective, and is cut off like a painting by its frame. The leaves of the trees are not as brilliant in color as they are in many other regions, but their soft reds and yellows harmonize perfectly with their surroundings. The sunsets are beyond description, and the death of day leaves a benediction of peace behind it. The beauty of the weather and of the earth is so great that the children, always near to nature's heart, feel it and speak of it in artless language. Transported to other lands, they never can forget it. Shut up in office or shop or factory, in the future they will long for it, but life will be made sweeter for its memory. In the fields the golden corn is ripe and awaits the harvest. Timely showers have put the soil in right condition for plowing. The farmer is happy in prosperity. The world rejoices, sharing his wealth. The autumn is a season worth living in Iowa. Its influences make one glad to be alive.—*Sioux City Journal.*

AERIAL OBSERVATIONS.

Philadelphia Press: "I want to get there—right there into the business end of the storm where the tornado is generated. I want the tornado's secret, its agent, and, God helping me, I shall have it. If electricity, then we may be able to dissipate Jove's awful wrath and relieve our great cities of their worst nightmare, their most insidious and most implacable foes."

The man who made this bold and striking remark is Prof. Henry Allen Hazen, expert meteorologist of the United States weather bureau, who has nearly completed arrangements for a series of not less than 1,000 high altitude balloon ascensions, to be made as often as three times a day, under a new and original principle of gas conservation, with new scientific instruments made in England expressly for the purpose.

The proposition is now before the board of advisers, who may be expected to report on the application as soon as Prof. Langley, secretary of the Smithsonian, shall return to his post. Prof. Langley himself is much interested in the subject of free air observation, especially in an idea of sending up self-registering instruments to the highest possible altitude without risking the presence of a human being in a balloon. Prof. Hazen, however, regards this method as only supplementary to the work of personal observation and instrument readings which he has in view.

Aerial transit across the Atlantic ocean is the ultimate object toward which Prof. Hazen's plans are tending. He states unreservedly that he will make the trip if he lives. He is already looking forward to the construction of a balloon basket in the form of a completely equipped open boat, with air tight compartments. In this vehicle, stored with food and drink for many days, the professor will set out without a qualm of fear. The only apparent difficulty that has ever beset the problem has been the inability of the aeronauts to keep the balloon on a steadily horizontal plane. The rising and the falling of the balloon can be regulated by an original device of Prof. Hazen. He will carry a bucket at the end of a long rope, and water drawn from the ocean will constitute the necessary ballast whenever his balloon seems to get more buoyant. The water will be poured out again when the balloon needs buoyancy.

THE WORLD'S RAINFALL.

In an article on rainfall the late Professor Elias Loomis, gave an exceedingly valuable table of the mean annual rainfall at seven hundred and thirteen stations scattered over the globe. The table includes the name of the station, its elevation above sea-level in feet, its latitude and longitude, the number of years over which the observations have extended, the rainfall in inches, and the authority for the facts stated. This table is divided into eight groups, classified according to the amount of the rainfall. The wettest portion of the globe seems to be Cherapunji in Assam, where the mean annual fall for over sixteen years reaches the enormous depth of 492½ inches, or upward of 60 feet, rather more than half of this quantity falling in the months of June and July. At several points in Chile and Peru, and also in northern Africa, no rainfall is recorded.

The following are given as the principal causes of excessive rainfall: (1) The meeting of the northeast and southeast trade winds, resulting in a great rain-belt surrounding the globe. (2) The irregular barometric depressions are not as distinctly marked by an excess of rainfall as might be expected; nevertheless storm tracks exhibit a tendency to incline toward districts where the rainfall is unusually great; *e. g*, Newfoundland, Iceland, coast of Norway, North Italy, etc. (3) Mountain ranges causing increased rainfall on the side from which the prevalent wind proceeds. (4) Proximity to the ocean, especially when the prevalent wind comes from the ocean; *e. g.*, Western Europe, eastern coast of South America, Africa, and Australia. (5) Capes and headlands projecting considerably into the ocean generally receives a greater rainfall than neighboring districts; *e. g.*, Cape Hatteras, Newfoundland, southwest coast of Ireland and England, Cape of Good Hope, etc.

The causes of deficient rainfall are thus summed up: (1) A nearly uniform direction of the winds throughout the year, such as prevails within a portion of the system of the trade winds, especially in mid-ocean, and to some extent over the continents; *e. g.*, Ascension Island, the Sahara, Southern California, South Africa, and Australia. (2) The prevalent wind, having passed over a range of elevated mountains, descends upon the leeward side; *e. g.*, Desert of Gobi, Tartary, Chile, North America, east of the Rocky Mountains, central portion of Spain, etc. (3) Ranges of mountains so situated as to obstruct the free movement of the surface winds toward a central region; *e. g.*, Desert of Gobi, Tartary, Southern California, Sala-

manca in Spain, etc. (4) Remoteness from the ocean measured in the direction from which the prevalent wind proceeds. There is a marked diminution in the mean annual rainfall as we advance eastward from Western Europe. A similar effect is noticeable in many other parts of the world, but it is generally complicated by the combination of other causes. (5) High latitude. Beyond the parallel of 60° north latitude, at a little distance from the ocean, the mean annual rainfall seldom much exceeds 10 inches; and there are apparently regions of great extent in Asia and North America where the annual rainfall is less than 10 inches.

CROPS SAVED BY FROST TORCHES.

As fine a display of fireworks as could be desired might have been witnessed after midnight the other morning in the mountainous farm lands coverning the northern portion of Saratoga county, New York. Frost comes early thereabouts, and three years out of five damages or destroys the corn and buckwheat.

A Swedish farmer on Hadly Hill suggested the use of "frost torches" in time of danger, and explained that Scandinavian agriculturists made them of petroleum-soaked peat. Peat is not handy in the locality of Hadly Hill, but pine is plentiful, so in odd times during the summer a number of farmers cut stakes 2 inches in diameter and 5 five feet long, and provided themselves with kerosene.

At 8 o'clock the other evening, the thermometer fell to 38°, and the experimenters put their stakes to soak. At midnight they set them up, 50 to the acre, in the buckwheat fields, and by 1 A M. had them blazing and smoking. Every man who tried the plan saved his crop. On other farms, where nothing was done, the probable yield is reduced at least two-thirds. The "frost torches" cost in all a half cent each.—*New York Sun.*

SIGNS OF A COLD WINTER.

We are informed by the shrewd observers of the signs of the season that the husks on corn are much thicker than usual this year and of a deep orange tint, instead of a light lemon hue which is one of the well established signs of the approach of a severe winter. But this isn't all. Returns from various rural sections where they look carefully into some of the details of nature, show that the goose bone reveals larger and whiter spots than usual and that the hog's melt runs jagged instead of smooth.

Those who have observed the preparations of the chipmunks and squirrels assert that they are laying in prodigious stores of nuts. The partridges and woodcock also are lighting in barns instead of trees and ducks are flying in U-shape instead of V-shaped flocks toward the south, while the green frogs are already changing their skins and seeking wells and springs for their winter quarters.

All these signs are taken to indicate that we shall have a severe winter, and a Chenango county, N. Y., weather prophet says that it will be the coldest winter since 1833, when we believe almost everything froze up and stayed frozen.

Some of these signs may be unreliable, frogs are whimsical and the chipmunks are sometimes unaccountable in their vagaries, but there is no use, probably, in disputing the goose bone and so we hope coal will be cheap and underwear thick this winter.—*Hartford Post.*

NATIONAL BULLETIN FOR OCTOBER.

TEMPERATURE.—The month was warmer than usual in central and eastern Texas and from the Upper Mississippi and lower Missouri valleys eastward to the New England and middle Atlantic coasts, the daily temperature averaging 3° per day above the normal in central Texas, eastern Nebraska and over the region of the upper lakes to the New England coast.

Over the Atlantic coast states southward of New Jersey about the normal temperature prevailed, except in portions of Maryland and over the interior of Virginia, where it was slightly cooler than usual. It was also cooler than usual in the lower Ohio valley, the central gulf states, the upper Missouri valley, and all the Pacific coast states.

Over western Tennessee, Alabama, Mississippi, Arkansas, and from the upper Missouri valley to the north Pacific coast, the average daily temperature for the month was generally from 3° to 4° below the normal.

The limit of freezing weather to the westward of the Mississippi has not extended southward of northern Arkansas, but to the eastward has reached east-central Mississippi, and up to the close of the month has not touched the Atlantic coast southward of Maine, although freezing temperatures have occurred over the interior of the middle Atlantic states and as far southward as western North Carolina.

RAINFALL.—The rainfall during October was largely deficient in the upper Mississippi and lower Missouri valleys and in the Gulf States, except along the east Gulf coast, where there was a marked excess. There was also a decided deficiency in western New York, southern New England, and at a few stations on the immediate coast from North Carolina northward.

Very little rain fell during the month in Iowa, and from Nebraska southward to Texas, over which region the deficiency ranges from 1 to 4 inches.

In eastern Michigan, generally throughout the Ohio valley, and in the Middle and South Atlantic states the rainfall was greater than usual, the excess being very large in eastern Florida, the Carolinas, and interior of Virginia. There was also more than the usual amount of rain from the upper Missouri valley to the north Pacific coast, the excess amounting to from 1 to 2 inches in western Washington and Oregon.

Upon the whole the month has been favorable for such farm work as is usually done at this season.

Winter wheat is up and is reported as looking well in the states to the east of the Mississippi, and while the crop is in fair to good condition in Kansas and Missouri, rains would prove beneficial in those states.

In Texas the general absence of rain was very favorable for cotton picking, which was nearing completion in some sections as early as October 20th, the reports generally

indicating that picking will be completed in that state this year earlier than usual. In Arkansas, however, the cotton crop will not be completely secured before November 15th, and possibly not before December 1st.

The frosts during the middle of the month caused some damage to cotton in Arkansas, Texas, Mississippi, and western Tennessee, but the reports indicate that the injury was slight.

OCTOBER WEATHER REPORT.

The month of October was warm and dry.

The mean temperature was 52.4°, which is about 8° above the normal for the State. There was less than the average amount of cloudiness, the records at the Central Station showing 254 hours of sunshine, or 74 per cent of the number of hours of possible sunshine during the month.

The average amount of precipitation was 1.28 inches, which is less than half the normal amount for the State. The distribution was quite unequal, the range being from .02 of an inch at Algona, to 4.56 inches at Blakeville.

The following table gives, as a basis of comparison, the mean temperature and total precipitation at the stations named, for the years from 1872 to 1893 inclusive:

YEARS.	MEAN TEMPERATURE, DEGREES.						PRECIPITATION, INCHES.					
	Des Moines.	Davenport.	Dubuque.	Keokuk.	Omaha.	Sioux City.	Des Moines.	Davenport.	Dubuque.	Keokuk.	Omaha.	Sioux City.
1872	....	52	...	55	53	....	.....	0.61	.....	0.42	3.89	.....
1873	....	48	46	49	54	....	.....	1.48	2.07	4.69	1.82	.....
1874	....	52	52	46	54	....	.....	1.30	2.14	1.94	1.45	.....
1875	....	49	52	51	50	....	.....	1.63	2.71	2.71	1.16	.....
1876	....	49	48	52	50	....	.....	1.54	1.10	2.12	0.69	.....
1877	....	54	52	56	52	....	.....	4.48	5.35	7.11	5.86	.....
1878	50	52	50	54	52	....	2.84	4.21	2.85	2.31	0.55	.....
1879	60	60	59	62	62	....	3.15	0.92	.93	0.28	3.64	.....
1880	49	51	49	52	50	....	4.90	0.94	.66	2.02	3.54	.....
1881	55	56	53	57	55	....	6.40	6.85	6.70	8.01	4.84	.....
1882	55	58	55	59	57	....	5.94	3.75	5.29	2.71	3.09	.....
1883	49	50	49	52	50	....	4.42	5.13	4.44	6.95	5.03	.....
1884	56	57	55	59	58	....	5.33	7.17	4.16	3.35	5.81	.....
1885	48	48	47	50	50	....	4.18	2.71	2.32	3.59	3.86	.....
1886	57	56	55	58	58	....	2.62	3.47	4.08	2.38	1.33	.....
1887	48	42	46	51	52	....	1.24	3.41	2.22	1.98	0.72	.....
1888	47	47	46	51	52	....	0.84	2.81	1.62	1.63	1.16	.....
1889	49	49	48	51	52	50	0.52	1.26	.66	2.88	0.34	.21
1890	52	52	51	54	52	50	4.48	3.63	6.43	2.44	1.09	1.84
1891	52	53	51	54	53	50	2.41	1.37	2.20	1.49	5.37	3.04
1892	55	56	55	57	57	55	2.54	0.55	.44	0.71	1.28	1.32
1893	55	55	53	57	55	51	0.22	0.80	1.66	0.33	0.12	.58
Means	52	52	51	54	54	51	3.25	3.04	2.92	3.24	2.55	1.40

SUMMARY OF WEATHER CONDITIONS.

BAROMETER—Mean pressure for the month, 29.99 inches; highest observed, 30.60 inches, at Clarinda and Des Moines, on the 29th; lowest observed, 29.22 inches at Dubuque, on the 6th. Range for the State, 1.38 inches.

TEMPERATURE—Monthly mean as determined from sixty-eight voluntary observers' reports, 52.4°. Highest monthly mean, 58.3°, at Hopeville; lowest monthly mean, 46.2°, at Osage. The highest temperature reported was 94°, at Glenwood, on the 10th; the lowest temperatue reported was 10°, at Emmetsburg, on the 29th. Average daily maximum, 65.3°; average daily minimum, 40.2°; average monthly maximum, 84.4°; average monthly minimum, 19.4°. Greatest monthly local range, 75°, at Emmetsburg; least monthly range, 50°, at Hopkinton. Range for the State, 84°.

PRECIPITATION—Average for the State as determined from seventy-three voluntary observers' reports, 1.28 inches. Greatest amount reported, 4.56 inches, at Blakeville; least amount reported, 0.02 inches, at Algona. Average number of days on which .01 or more inches fell, 4.1; number of cloudy days, 6; partly cloudy days, 9; clear days, 16.

FROSTS—Occurred quite generally over the State on the 3d, and freezing weather on the 15th.

AURORAS—Alta, 9th; very light.

THUNDER STORMS—Quite general throughout the State on the 5th; scattering storms on the 1st, 10th, 11th, 12th, 23d and 25th.

GALES—Cedar Rapids, from the northwest on the 6th; Humboldt, 5th.

EXCESSIVE PRECIPITATION—Cresco reports 3.08 inches in 9 hours on the 5th.

LUNAR HALO—Hopeville, 31st.

SOLAR HALO—Hopeville, 7th.

ATMOSPHERIC PRESSURE.

STATIONS.	Mean reduced barometer.	EXTREMES. Highest barometer	Date.	Lowest barometer	Date.
Cresco	.....	30.56	29	29.26	6
Clarinda	30.00	30.60	29	29.52	5
Cedar Rapids	30.00	30.56	29	29.38	6
Davenport	29.99	30.54	29	29.35	6
Des Moines	29.99	30.60	29	29.45	6
Dubuque	29.98	30.52	29	29.22	6
Keokuk	30.01	30.57	29	29.51	5
Omaha (Neb)	30.00	30.57	29	29.55	1
Sioux City	29.98	30.56	29	29.51	1
Means	29.99	30.60	....	29.22	....

WIND MOVEMENT.

STATIONS.	Miles.	Maximum velocity.	Direction.	Date.
Davenport	7,446	48	W	6
Des Moines	6,618	36	SW	23
Dubuque	4,358	26	NW	6
Keokuk	5,363	36	W	6
La Crosse (Wis)	6,572	36	NW	6
Omaha (Neb)	6,240	33	N	11
Sioux City	7,803	34	NW	11

OBSERVERS' NOTES.

Alta—DAVID E. HADDEN: A very dry month. Wells throughout the country are very low.

Bonaparte—HON. B. R. VALE: A very seasonable month; the last half has been improved in cribbing corn.

Murray—A. W. LEWIS: On the evening of the 26th, at 8:55, a very bright meteor appeared in the northwest, which exploded when about 40° above the earth. It was bright enough to throw a shadow against the rays

of a very bright full moon. When the explosion occurred it had the appearance of a very large rocket.

Clinton—DR. LUKE ROBERTS: October, 1893, was a fine month. In temperature was 2.1° above normal. The number of clear days was 15, cloudy days only 3, and fair days 13. The number of storm days was but 4, and these furnished only .68 of an inch of rainfall, while a normal rainfall for October is 2.67 inches. As a rule October is not a stormy month. The greatest precipitation for October for the last fifteen years was 5.55 inches. This was in 1881.

The maximum temperature was normal, while the minimum temperature was five degrees below normal. The warmest day was 2.4 above normal and the coldest day 4.9 below normal. The warmest day was the 1st and the coldest the 29th. The principal meteorological conditions for October may be epitomized as follows:

Highest temperature, 82°; lowest temperature, 18°; extreme range, 64°; mean temperature of warmest day, 70.5°; mean temperature of the coldest day, 27.2; mean temperature, 51.2°. number of stormy days, 4; total precipitation, .68 in.; number of clear days, 15; number of cloudy days, 3; per cent of cloudiness, 32.

The prevailing direction of wind was south. The maximum velocity was 26 miles an hour. Total movement of wind, 4 260 miles. Thunder and lightning on the 1st.

The 14th was a notable day for wind, but no local damage. A wide spread and damaging storm prevailed along the lakes and the coast from Florida to New York, and also inland to Buffalo. A light frost on the 5th and heavy frosts on the 16th, 17th, 24th, 25th, 27th, 28th, 29th and 30th. A heavy fog on the 16th.

DELAYED METEOROLOGICAL REPORTS.

The following reports were received too late for publication in the September Review:

MARSHALLTOWN—September mean temperature, 64.2°; mean maximum temperature, 76.3°; mean minimum temperature, 52.1°; maximum temperature, 90°, on the 8th: minimum temperature, 33° on the 25th. Total precipitation, 1.73. .01 inch or more rain fell on 3 days. Cloudy days, 2; clear days, 24; partly cloudy, 4. Prevailing wind, north.

METEOROLOGICAL DATA FOR OCTOBER, 1893.

STATIONS.	TEMPERATURE OF THE AIR (IN DEGREES FAHRENHEIT).								Precipitation in inches—monthly.	Prevailing direction of wind.	Killing frost.	No. of cloudless days.	No. of partly cloudy days.	No. of cloudy days.	No. of rainy days. (.01 inch or more).	No. of hail-storms.	No. of thunder-storms.
	Monthly mean.	EXTREMES. Mean maximum.	Mean minimum.	Maximum.	Date.	Minimum.	Date.	Monthly range.									
Algona	49.4			*85	8	*15	29	70	0.02	NW	....	10	15	6	1	..	..
Alta	49.9	62.6	37.2	85	8	15	29	70	0.23	NW	....	16	9	6	5	..	1
Ames (W. R. Cooper)	51.1	66.5	35.6	87	1	15	29, 30	72	0.85	NW	....	18	9	4	3	..	..
Ames (W. H. Heileman)									0.89						4	..	..
Amana	51.9	63.0	40.7	82	1	19	29, 30	63	2.02	NW	....	17	10	4	5	..	..
Audubon	50.0	66.1	38.0	84	8	18	28	66	0.18	SW	....	11	16	4	2	..	6
Belle Plaine	51 8	63.5	40.1	84	1	17	29	67	2.67	S	....	14	11	6	6	..	..
Blakeville	53.6			*86	8	*18	29	68	4.56	SE	...	11	8	12	6	..	..
Bonaparte	55 1	68.3	42.0	91	1	23	30	68	1.45						4	..	..
Carroll	51.0	63.9	38.2	87	8	18	28	69	1.10			23	3	5	2	..	..
Cedar Falls	53.1	67.7	38.5	85	8	15	29	70	3.53	NW	....	16	8	7	4	..	..
Cedar Rapids	52.7	62.5	42.8	80	10	23	29	57	2.63	W & NW	..	19	6	6	7	..	..
Centerville	54.3	68.8	39 8	81	1	25	27, 28	56	1.30	NW	....	21	7	3	1	..	..
Charles City	52.5	63.2	41.8	84	8, 10	13	20	71	1.28	NW	....				6	..	..
Clarinda	54.0	65.6	42.4	80	9, 10	26	28	54	0.09	S	..	22	8	1	1	..	..
Corning	54.2	67.5	40.9	84	8, 9	21	28	63	0.22	SW	....					..	..
Cresco	49 0	60.2	37.7	81	10	14	29	67	3.40	S	....	12	10	9	5	..	..
Davenport	54.7	64.3	45.1	82	11	24	30	58	0.80	S	....	13	11	7	7	..	..
Decorah	50.8	62.2	39 4	82	10	14	29	68	2.13		....	15	7	9	5	..	..
Delaware	48 3			*83	10	*19	20	64	3.27	S	....	12	6	13	9	..	..
Des Moines	54.8	66.5	43.2	86	8	22	29	64	0.22	NW	....	18	13	0	5	..	..
Des Moines (5¼ miles southeast of)	54.9	67.3	42.5	85	1	24	28, 30	61	0.48	SW&NW	....	16	9	6	2	..	1
Dubuque	53.3	63.0	43.4	82	10	22	30	60	1.66	NW	....	10	8	13	8	..	..
Elkader	51.6	64.3	39.0	85	10	16	30	69	3.23	NW	....	17	9	5	9	..	..
Emmetsburg	49.8	64.9	34 6	85	8, 9	10	29	75	0.15	NW	....	22	3	6	2	..	5
Ft. Madison	57.4	....	.....	*84	1	*28	30	56	0.35		....	15	11	5	1	..	..
Fulton	52.2			82	10, 11	16	30	66	0.12	SW	....	16	6	9	2	..	1
Galva	50.4	63.8	37.0	86	8	16	29	70	0.06	SW	....	7	5	13	2	..	..
Glenwood	58.4	73.1	43.6	94	10	24	28	70	0.22	S	....	19	9	3	2	..	..
Grand Meadow	50.4			*74	23	*22	29	52	3.02	S	....				5	..	..
Greenfield	53.2	67.9	34.6	86	15	21	28	65	0.23	S	....	15	6	3	2	..	..
Grinnell	55.1	66.2	44.0	85	1	22	29	63	1.56	S	....	18	8	5	4	..	..
Grundy Center	50.6	64.3	37.5	85	1	16	28	69	2.22	NW	....	19	11	1	4	..	2
Hampton	50.3	62.3	37.3	84	8	13	29	71	1.63	NW	....	16	10	5	4	..	..
Hopeville	68.3	70.5	46.2	84	1	28	15	56	0.21						4	..	..
Hopkinton	55.2			*79	10	*29	28, 29	50	3.51	SE						..	..
Humboldt									0.10	S	....	17	12	2	4	..	..
Independence	53.1	66 6	39.6	83	10	18	29	65	3.65	S	....	16	11	4	3	..	1
Indianola	57.5	67.6	47.1	89	2	20	29	69	0.20	SW	....	7	15	9	4	..	2
Iowa City	54.3	67.5	41 1	83	10	19	30	64	1.98	SE	....	15	13	3	5	..	1
Iowa Falls	49.0	62.0	35.9	85	1	11	26	74	0.89	NW	....				2	..	..
Jefferson	55.1	70.2	39.9	85	2	20	28, 29	65	0.45		....				1	..	..
Knoxville	54.2	65.5	42.8	87	1	22	29	65	1.50	NW	....	15	8	7	5	..	..
Keokuk	57 0	68.0	46.0	90	1	27	30	63	0.33	NW	....	21	7	3	4	..	..
Keosauqua	57.1	69 8	44.4	89	1	23	30	66	1.08						4	..	1
Le Claire									0.36							..	..
Larrabee	49.0	63.2	34.7	80	10	13	29	67	0.89	S	....				4	..	..
Logan	55.9	69.9	41.9	88	9	22	15	66	0.15	S	....	24	2	5	1	..	..
Maquoketa	47.7								0.78						3	..	..
Mason City	58.6	60.4	36 6						1.63						6	..	..
Maxon	53.7			*89	1	*23	29	66	1.92		....	15	14	2	4	..	1
Mechanicsville	50.0	61.3	39.7	79	10	20	29	59	1.70	S	....	12	10	9	7	..	..
Monticello	49.9	59.4	40.2	*81	10	*16	30	65	2.08	S & NW	....	18	7	6	8	..	2
Mt. Vernon	51.0			79	10	22	29	57	4.12						6	..	..
Murray									0.05							..	..
Omaha	55.4	66.8	44.0	89	8	24	28	65	0.12	NW	....	20	7	4	3	..	..
Osage	46.2								1.69			15	6	10	6	..	..
Oskaloosa	53 5	66.6	40.5	88	1	20	30	68	1.20	SW	....	23	3	5	4	..	..
Ovid	53.2	68.2	42.1	88	1	23	8	65	1.32						3	..	..
Panama	53 1	66.0	40.2	89	8	21	28	68	0.12	SW	....	19	5	7	2	..	..
Richland	53.8								1.64		....	14	16	1	5	..	..
Rock Rapids	47 5	62.6	32.4	80	21	15	29	65	1.05	S	....	14	10	7	3	..	..
Seymour	53.7	66.3	38.0	87	1	15	24	72	1.20	S	....	23	7	1	3	..	..
Sibley									0.53						4	..	..
Sioux City	51 0	63.3	39.1	86	8	21	15	65	0.58	NW	....	17	7	7	9	..	..
Spirit Lake	49.0	62.8	35.2	*83	8	*12	29	71	1.35	NW	....	20	5	6	5	..	..
Storm Lake	51.7	63.2	40.1	81	8	17	29	64	0.10	S	.	22	6	3	2	..	..
Tipton	48 7	59.7	37.7	80	1	21	28	59	1.71	SW	..				4	..	..
Vinton	51.3			*81	8	*20	29	61	2.57	SW	....	19	8	4	5	..	1
Washington	54.9	64.9	44.9	*88	1	*23	29	65	1.15	NW	....				4	..	..
Webster City	50.3			*86	8	*22	29	64	0.50	SE	....	13	16	2	1	..	..
Williams	49 7			*84	1	*11	29	73	1.06	>	....	14	15	2	5	..	3
Winterset	54.8	67.4	42 2	86	10	22	29	64	0.15	S	...	15	8	8	1	..	..
Means	52 4	65.3	40.2	84.4	.....	10.4	...	65.0	1.28	.....	....	10.3	8.9	5.5	4.1	..	2

*Extremes taken from eye readings; all others from self-registering instruments.

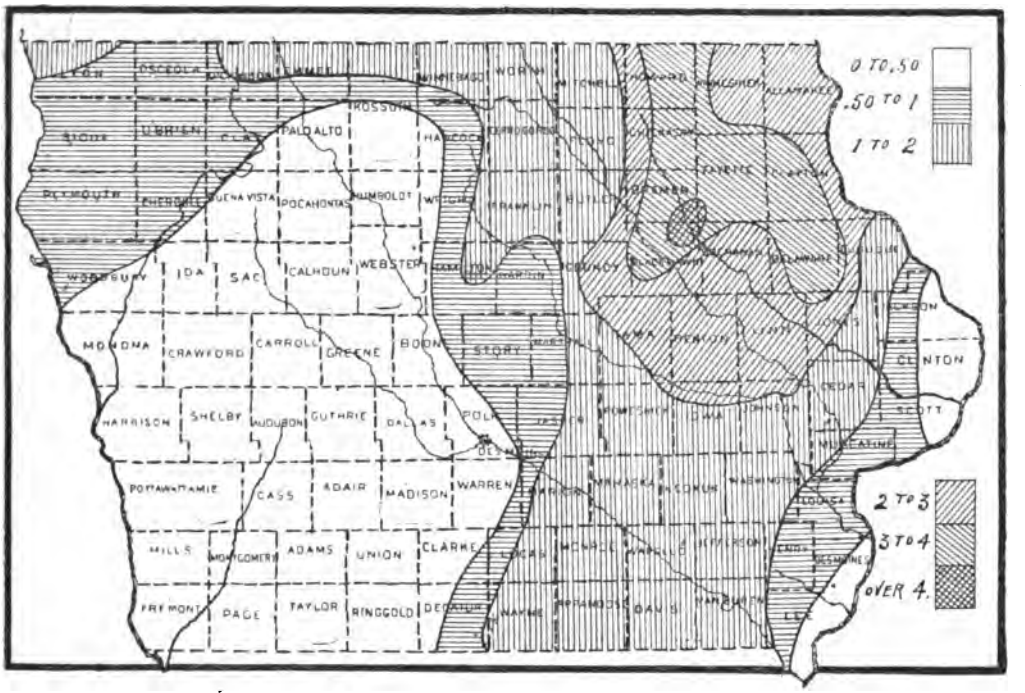
STATIONS.	DATE.																													Monthly mean.
	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th	27th.	28th.	29th.	30th.	31st.	
Algona	67	51	49	50	54	48	54	64	62	67	47	46	50	36	40	57	55	54	46	52	68	66	46	36	44	36	37	29	28	48	54	49.4
Alta	66	46	50	50	49	53	56	65	61	72	47	44	50	41	38	58	58	57	46	53	56	66	49	34	43	39	42	26	29	45	59	49.1
Ames (W. R. Cooper)	73	61	48	58	43	54	55	62	62	66	64	60	54	46	38	41	52	58	50	52	52	63	63	32	38	41	42	30	28	38	44	51.1
Amana	72	56	49	50	62	56	56	62	63	68	69	54	55	46	41	47	52	56	56	50	54	62	63	39	40	46	42	30	30	36	55	51.9
Audubon	68	48	50	57	54	58	59	62	66	70	58	48	49	42	39	56	57	60	48	52	57	64	56	45	42	42	40	29	33	42	62	52.0
Belle Plaine	72	56	47	50	62	50	64	62	64	70	66	52	55	44	39	48	52	57	52	50	53	62	59	38	42	38	44	30	28	36	52	51.6
Blakeville	60	61	56	54	64	56	60	68	69	66	70	57	57	45	48	48	52	56	59	59	56	60	62	60	40	38	38	31	29	41	42	53.1
Bonaparte	77	63	52	59	66	58	60	65	68	72	72	58	57	48	44	50	54	61	56	52	56	64	66	40	43	44	46	34	55	36	51	55.1
Carroll	64	46	47	52	59	55	56	67	63	71	55	46	48	49	45	58	56	50	52	55	57	66	56	39	40	40	36	25	34	40	54	51.0
Cedar Falls	70	69	51	53	60	58	59	62	64	68	69	60	52	50	44	47	50	55	54	56	55	63	62	44	39	43	42	29	25	37	54	53.1
Cedar Rapids	70	60	50	51	58	55	58	62	72	70	60	51	42	41	49	55	58	57	51	54	62	64	40	42	43	42	34	32	32	38	54	52.7
Centerville	71	50	56	58	56	58	62	60	59	59	58	52	51	53	57	54	55	60	55	57	62	64	55	48	46	40	45	36	48	53	53	54.5
Charles City	66	54	49	56	58	49	62	66	64	73	70	46	50	45	39	52	56	55	50	50	53	63	66	39	49	44	40	36	29	44	56	52.5
Clarinda	68	50	52	58	57	55	58	64	66	72	63	49	53	46	42	56	57	62	54	54	56	64	58	42	47	45	47	33	38	44	61	54.0
Corning	70	52	...	52	61	54	60	66	66	72	64	60	52	47	40	56	56	60	54	52	59	64	62	38	48	44	48	33	36	45	61	54.2
Cresco	61	50	50	52	56	51	52	61	58	68	62	49	52	42	40	50	54	55	47	52	54	62	54	34	38	36	41	27	28	34	52	49.0
Davenport	70	60	52	56	64	56	60	64	67	70	72	64	56	48	44	50	55	56	58	52	58	63	66	40	44	44	46	32	32	38	57	55.0
Decorah	60	50	50	54	60	47	56	60	65	72	62	54	50	39	48	54	55	57	49	48	64	68	54	35	44	35	40	27	24	36	48	50.3
Delaware	65	60	53	48	58	51	50	58	58	65	66	52	52	43	40	46	48	52	51	45	48	58	46	33	35	42	38	29	25	31	52	48.3
Des Moines	75	52	51	54	61	56	60	67	70	74	67	52	57	46	42	54	58	62	54	56	60	66	62	42	43	46	46	32	32	42	61	54.8
Des Moines (5½ miles se of)	75	62	50	54	60	58	60	66	68	68	68	50	56	50	41	53	57	60	55	52	62	66	64	42	42	45	46	34	34	42	60	54.9
Dubuque	65	58	51	51	62	56	58	63	62	68	71	56	55	46	46	49	56	58	58	50	56	64	65	40	42	43	45	32	32	36	55	53.3
Elkader	62	56	52	52	60	54	55	62	60	68	70	52	56	44	44	48	54	56	52	52	54	65	68	39	38	38	42	30	30	34	54	51.6
Emmetsburg	62	50	50	58	50	54	56	62	72	63	53	42	51	44	40	52	58	52	46	54	54	62	52	34	40	40	35	29	26	38	56	49.8
Ft. Madison	76	60	55	60	62	58	60	68	72	76	76	64	57	48	45	56	57	59	50	52	59	67	70	44	43	46	50	35	42	44	63	57.4
Fulton	70	58	48	52	66	55	62	64	64	70	72	56	54	45	41	46	49	52	50	45	52	63	61	34	45	44	44	54	26	38	58	52.2
Galva	66	58	52	53	52	52	55	66	63	72	55	48	49	46	36	56	...	...	...	...	...	...	55	42	44	40	42	28	30	42	61	50.4
Glenwood	72	54	55	60	59	58	64	75	70	80	64	59	52	48	47	61	63	65	58	64	63	70	66	47	51	47	58	34	39	49	57	58.4
Grand Meadow	64	57	49	52	60	49	53	63	61	61	63	50	50	47	41	50	60	56	50	50	58	64	56	36	44	38	38	31	28	38	54	50.4
Greenfield	72	67	60	64	64	54	55	...	...	...	...	...	...	...	55	58	57	63	56	54	57	63	48	39	47	43	49	52	36	43	64	53.2
Grinnell	72	63	58	54	63	62	60	68	66	72	70	53	54	48	41	49	50	63	54	56	60	61	65	52	42	42	44	35	35	42	56	55.1
Grundy Center	68	48	54	53	59	52	58	64	62	70	62	50	50	38	40	54	54	56	48	52	60	64	52	38	43	38	42	26	28	40	54	50.8
Hampton	64	51	48	47	58	52	54	63	59	71	61	50	52	40	38	52	56	58	50	50	54	60	58	36	40	42	42	28	25	38	56	50.3
Hopeville	72	53	52	58	62	54	59	66	68	72	64	53	55	47	46	56	56	60	55	54	62	64	...	...	...	...	...	...	...	...	...	58.3
Hopkinton	67	56	53	54	65	55	58	68	65	71	68	54	55	45	46	52	56	59	58	51	59	64	68	40	48	...	49	30	34	43	59	55.2
Independence	66	64	50	50	61	58	56	61	64	70	68	60	54	49	40	48	52	58	56	50	55	55	65	51	58	44	47	38	29	38	52	54.1
Indianola	76	70	51	55	62	58	60	66	68	73	70	59	58	46	54	57	61	...	...	...	63	68	74	63	40	48	46	37	31	43	63	57.5
Iowa City	72	58	53	50	63	59	57	62	64	72	70	64	56	50	43	48	54	58	54	50	54	62	64	53	40	47	43	39	33	37	55	54.3
Iowa Falls	72	55	48	50	54	53	54	62	68	70	...	48	52	41	38	52	57	49	50	54	56	36	39	38	28	25	...	...	26	36	56	49.0
Jefferson	...	62	50	56	56	58	56	...	65	75	68	50	55	52	...	50	55	60	56	55	58	65	59	40	45	42	42	40	40	57	...	55.1
Knoxville	75	54	50	53	60	59	62	64	68	72	70	50	56	45	38	56	56	58	56	54	60	64	63	41	42	45	44	30	32	43	59	54.2
Keokuk	78	60	55	62	65	58	64	68	72	72	72	60	58	50	42	52	55	58	60	54	58	64	66	42	45	44	48	36	36	42	58	57.0
Keosauqua	77	66	54	60	65	58	64	66	68	72	74	64	57	50	44	51	55	58	56	54	58	65	66	...	43	42	48	38	36	41	60	57.1
La Crosse (Wis)	63	55	52	52	58	54	54	63	60	68	66	50	54	46	46	50	58	58	54	52	66	66	65	39	40	42	44	34	30	35	55	52.0
Larrabee	65	46	50	50	47	52	56	64	62	70	48	46	48	41	39	53	58	54	46	52	53	60	46	35	42	38	42	28	28	39	60	49.0
Logan	64	54	54	60	60	56	60	70	72	74	58	54	48	46	44	60	63	64	50	52	50	60	69	55	50	52	50	44	51	34	41	47	61	56.9
Maquoketa	70	60	54	52	62	58	56	56	65	64	71	...	...	44	40	46	50	49	52	46	55	58	57	38	44	42	42	32	28	37	48	47.7
Mason City	58	54	54	59	50	53	...	...	...	...	...	...	...	...	48	46	57	58	48	53	54	60	55	36	42	34	42	32	32	36	54	48.6
Maxon	78	51	52	59	66	52	60	69	71	74	63	52	54	42	39	54	55	58	52	52	58	67	56	36	43	37	44	32	30	47	60	53.7
Mechanicsville	68	56	48	50	59	54	55	61	63	68	67	54	54	44	41	46	48	54	52	48	54	55	62	37	40	42	44	30	30	36	54	50.5
Monticello	68	57	47	50	61	52	56	60	60	68	66	54	54	44	40	45	50	54	53	48	51	60	60	36	38	48	42	29	28	32	53	50.0
Mt. Vernon	73	56	51	56	64	52	58	68	65	70	71	54	54	43	42	50	53	57	53	51	57	64	56	38	47	40	44	30	30	40	56	53.1
Omaha (Neb)	64	51	56	59	57	57	63	72	70	74	52	48	52	46	45	61	62	64	54	58	61	68	58	43	48	44	51	32	36	46	64	55.4
Osage	64	48	44	46	54	46	52	59	54	66	55	48	48	40	44	48	50	52	40	42	48	58	49	30	40	36	32	30	21	36	49	46.2
Oskaloosa	76	59	52	52	63	55	58	62	66	72	68	52	56	46	41	51	54	58	56	53	54	64	61	41	41	40	44	33	32	40	60	53.5
Ovid	76	50	53	55	62	53	58	67	70	71	62	51	52	42	41	54	54	56	53	53	56	64	55	38	44	39	43	34	34	47	61	53.2
Panama	64	50	52	56	52	54	60	68	70	73	54	48	48	44	42	59	60	60	52	60	58	66	55	39	45	42	46	30	35	44	60	53.1
Richland	76	54	52	57	63	52	58	64	66	67	71	57	57	40	46	50	52	62	52	52	60	64	57	42	44	40	40	34	38	44	58	53.8
Rock Rapids	54	47	53	44	46	50	54	57	57	60	36	42	50	50	53	55	49	54	54	50	56	54	46	34	36	34	40	27	32	42	56	47.5
Seymour	75	64	52	56	62	58	59	64	69	73	70	56	55	48	42	52	52	58	56	54	58	62	52	32	35	36	38	37	44	39	55	53.7
Sioux City	58	47	56	54	50	55	58	68	66	70	48	44	49	44	40	60	60	52	50	57	56	66	41	40	42	38	47	28	34	45	62	51.2
Spirit Lake	70	48	51	46	45	53	54	62	60	70	48	41	50	34	36	36	54	57	45	54	49	64	48	33	38	38	46	43	26	55	55	49.0
Storm Lake	62	52	52	52	50	52	58	64	63	70	58	44	53	46	42	56	59	58	49	55	55	66	56	37	47	40	43	29	30	48	56	51.7
Tipton	70	52	52	51	63	...	...	...	...	...	...	...	56	40	44	51	54	54	56	50	...	...	55	38	48	38	42	29	33	48	...	48.7
Vinton	69	54	53	53	64	51	56	65	65	70	62	53	53	42	40	52	52	50	50	50	57	63	64	36	44	38	41	30	28	43	52	51.3
Washington	82	58	60	56	64	56	61	66	69	68	74	58	54	45	41	50	52	50	58	52	56	62	58	38	48	42	43	32	33	41	58	54.9
Webster City	62	44	50	52	58	49	60	64	62	70	58	50	53	44	46	54	58	60	48	46	58	64	54	38	46	38	32	26	28	44	54	50.3
Williams	67	47	51	52	59	48	58	64	63	68	56	49	48	30	38	55	52	58	46	49	58	64	53	34	42	37	36	29	28	45	54	49.7
Winterset	76	52	51	55	58	54	58	66	69	75	72	50	55	46	42	57	60	63	54	54	62	56	64	48	44	45	46	32	32	44	60	54.6

DAILY AND MONTHLY PRECIPITATION FOR OCTOBER, 1893.

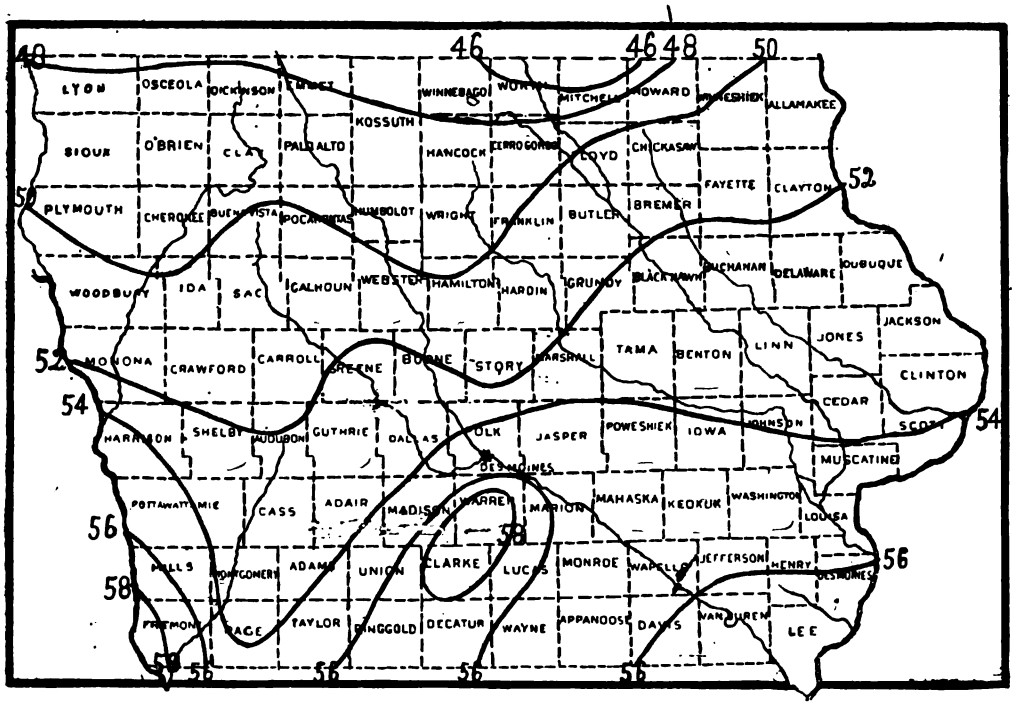
STATIONS.	DATE.																																	Total.
	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	31st.		
Algona	....	....	....	....	0.02	....	....	....	....	....	T	....	....	....	....	....	....	....	....	....	....	....	....	....	0.02	....	T	....	....	....	....	0.02
Alta	....	0.01	....	T	0.02	....	....	....	....	....	T	....	....	....	....	....	....	....	....	....	....	....	T	....	0.05	0.05	0.10	....	....	....	....	0.23
Ames (W. R. Cooper)	....	....	....	....	0.60	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.10	0.15	....	....	....	....	0.85
Ames (W. H. Heilman)	....	....	....	....	0.67	....	....	....	....	....	0.07	....	....	....	....	....	....	....	....	....	....	....	....	....	0.07	....	0.08	....	....	....	....	0.89
Amana	....	0.09	....	....	....	0.84	....	....	....	....	....	0.91	....	....	....	....	....	....	....	....	....	....	....	....	....	0.08	....	0.10	....	....	....	2.02
Audubon	....	....	....	....	....	0.02	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.16	....	....	....	....	....	0.18
Belle Plaine	0.10	0.10	....	....	....	1.28	....	....	....	....	1.02	....	....	....	....	....	....	T	....	....	....	....	T	....	T	0.11	0.06	....	....	....	....	2.67
Blakeville	1.60	T	....	....	1.78	0.22	....	....	....	....	0.78	....	....	....	....	....	T	....	....	....	....	....	....	....	....	0.06	0.12	....	....	....	....	4.23
Bonaparte	....	....	....	....	0.28	....	....	....	....	....	0.97	....	T	....	....	....	....	....	....	....	....	....	....	....	0.15	....	0.05	....	....	....	....	1.45
Carroll	....	....	....	....	0.07	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.03	....	T	....	....	....	....	....	0.10
Cedar Falls	0.90	....	....	....	....	1.90	....	....	....	....	0.63	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.10	....	....	....	....	....	3.53
Cedar Rapids	T	0.26	....	....	....	0.58	....	....	....	....	....	1.24	....	....	....	....	....	....	T	....	....	....	....	T	....	0.27	....	0.07	....	....	....	2.63
Centerville	T	T	....	....	....	....	....	....	....	....	1.30	....	....	....	....	....	....	....	....	....	....	....	....	....	T	....	T	....	....	....	....	1.30
Charles City	....	....	T	0.02	0.38	0.75	....	....	....	....	....	....	0.04	....	....	....	....	....	....	....	....	....	....	....	T	0.06	0.03	....	....	....	....	1.28
Clarinda	....	....	....	....	0.09	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	T	....	....	....	....	0.09
Corning	....	....	....	....	....	0.22	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	T	....	....	....	....	....	....	0 22
Cresco	0.07	....	....	0.15	3.08	....	....	....	....	....	T	....	T	....	....	....	....	....	....	....	....	....	T	....	T	0.05	0.05	....	....	....	....	3.40
Davenport	0.03	0.44	....	....	....	0.17	....	....	....	....	....	0.01	....	....	....	....	....	....	T	....	....	....	T	....	T	0.11	0.01	0.03	....	....	....	0.80
Decorah	....	....	....	....	1.30	0.10	....	....	....	....	0.50	....	....	....	....	....	....	....	....	....	....	....	....	....	0.15	....	0.08	....	....	....	....	2.13
Delaware	0.40	0.07	....	....	0.35	1.05	....	....	....	....	1.06	0 02	....	....	....	....	....	0.02	....	....	....	....	....	....	0.25	....	0.05	....	....	....	....	3.27
Des Moines	....	....	....	....	....	0.12	....	....	....	....	....	0.04	....	....	....	....	....	....	T	....	....	....	T	....	0.01	0.03	0.02	....	....	....	....	0.22
Des Moines (5½ miles southeast of)	....	....	....	....	0.20	....	....	....	....	....	0.28	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	T	....	....	....	....	0.48
Dubuque	0.02	0.29	....	....	....	0.56	....	....	....	....	0.02	0.12	....	....	....	....	....	....	....	....	....	....	0.05	....	....	0.48	0.12	....	....	....	....	1.66
Elkader	0.51	0.16	....	....	0.22	0.98	T	....	....	....	1.00	0.12	....	....	....	....	....	0.02	....	....	....	....	....	....	T	0.16	0.06	....	....	....	....	3.23
Emmetsburg	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.10	....	0.05	....	....	....	0.15
Ft. Madison	....	....	....	....	0.35	....	....	....	....	....	....	T	T	....	....	....	....	....	....	....	....	....	T	....	....	....	....	....	....	....	....	0.35
Fulton	....	....	....	....	....	0.09	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.03	....	....	....	....	....	0.12
Galva	....	....	....	0.02	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.04	....	....	....	....	0.06
Glenwood	....	....	....	....	....	0.14	....	....	....	....	....	0.08	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.22
Grand Meadow	....	0.10	....	....	....	1.12	....	....	....	....	....	1.56	....	....	....	....	....	....	....	....	....	....	....	....	....	0.11	0.13	....	....	....	....	3 02
Greenfield	T	....	....	....	0.21	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	T	T	0.02	....	....	....	....	0.23
Grinnell	....	0.20	....	....	....	T	....	....	....	....	T	1.20	....	....	....	....	....	0.01	....	....	....	....	T T	....	T	0.15	....	T	....	....	....	1.56
Grundy Center	0.02	....	....	....	1.72	....	....	....	....	....	0.41	....	....	....	....	....	....	....	....	....	....	....	T	....	T	....	0.07	....	....	....	....	2.22
Hampton	T	....	....	T	....	1.45	....	....	....	....	0.03	....	....	....	....	....	....	T	....	....	....	....	T T	....	0.09	....	0.06	....	....	....	....	1.63
Hopeville	....	....	....	....	....	0.08	....	....	....	....	....	0.02	....	....	....	....	....	T	....	....	....	....	....	....	0.09	....	0.02	....	....	....	....	0.21
Hopkinton	0.75	....	....	....	1.45	....	....	....	....	....	1.05	....	....	....	....	....	....	....	....	....	....	....	....	....	0.26	....	T	....	....	....	....	3.51
Humboldt	....	....	....	....	....	0.02	....	....	....	....	0.01	....	....	....	....	....	....	....	....	....	....	....	....	....	0.01	....	0.06	....	....	....	....	0.10
Independence	1.30	....	....	....	....	1.60	....	....	....	....	0.75	....	....	....	....	....	....	....	....	....	....	....	T	....	T	....	T	....	....	....	....	3.65
Indianola	....	....	....	....	....	0.02	....	....	....	....	....	0.59	....	....	....	....	....	....	....	....	....	....	....	T	0.04	0.05	....	....	....	....	....	0.20
Iowa City	0.11	0.01	....	T	....	0.76	....	....	....	....	....	0.93	....	....	....	....	....	....	....	....	....	....	....	....	....	0.17	....	....	....	....	....	1.98
Iowa Falls	....	....	....	....	0.77	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.12	....	....	....	....	....	0.89
Jefferson	....	T	....	....	....	0.45	....	....	....	....	....	T	....	....	....	....	....	....	....	....	....	....	....	....	....	T	....	....	....	....	....	0.45
Knoxville	0.20	0.25	....	....	....	0.75	....	....	....	....	....	....	0.23	....	....	....	....	....	....	....	....	....	T T	....	....	0.06	T	....	....	....	....	1.50
Keokuk	....	0 05	....	....	....	0.23	....	....	....	....	....	0.04	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.01	....	....	....	0.33
Keosauqua	....	0.15	....	....	....	0.19	....	....	....	....	....	0.32	....	....	....	....	....	....	....	....	....	....	T T	....	....	0.42	T	....	....	....	....	1.08
La Crosse (Wis)	T	T	....	....	0.49	0.70	....	....	....	....	0.12	0.04	....	....	....	....	....	....	....	....	....	....	....	....	T	0.17	0.08	T	....	....	....	1.60
Larrabee	....	T	....	T	0.46	....	....	....	....	....	0.11	....	....	....	....	....	....	....	....	....	....	....	....	....	0.23	....	0.09	....	....	....	....	0.89
Logan	....	....	....	....	....	0.15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0 15
Maquoketa	....	0.18	T	....	....	0.45	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.15	....	....	....	....	....	....	0.78
Mason City	....	....	0.08	....	1.30	....	....	....	....	....	....	0.10	....	....	....	....	....	....	....	....	....	....	....	....	0.03	0.07	0.05	....	....	....	....	1.63
Maxon	....	0.22	....	....	0.29	....	....	....	....	....	1.30	....	T	....	....	....	....	....	....	....	....	....	....	....	T	....	0.11	....	....	....	....	1.92
Mechanicsville	0.27	0.01	....	....	0.40	0.50	....	....	....	....	....	0.33	....	....	....	....	....	....	....	....	....	....	....	....	....	0.12	0.07	....	....	....	....	1.70
Monticello	0.01	0.31	....	....	....	0.85	....	....	....	....	....	0.58	....	....	....	....	....	....	....	....	....	....	....	....	0.27	....	0 06	....	....	....	....	2.08
Murray	....	....	....	....	T	....	....	....	....	....	....	T	....	....	....	....	....	....	....	....	....	....	....	....	0.02	....	....	0.03	....	....	....	0.05
Omaha (Neb)	....	....	....	....	T	0 05	....	....	....	....	....	0.04	....	....	....	....	....	....	....	....	....	....	....	....	T	T	T	T	0.03	....	....	0.12
Osage	....	....	....	T	....	1 35	....	....	....	....	0.15	....	0.04	....	....	....	....	....	....	....	....	....	T T	....	0.06	....	....	0.09	....	....	....	1.69
Oskaloosa	0.21	....	....	....	....	0.25	....	....	....	....	....	0.62	....	....	....	....	....	....	....	....	....	....	....	....	0.12	T	....	....	....	....	....	1.20
Ovid	....	0.64	....	....	....	0.11	....	....	....	....	0.49	....	....	....	....	....	....	....	....	....	....	....	....	....	0.04	....	0.04	....	....	....	....	1.32
Rockwell City	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	T	....	....	....	....	....	....	0 04	....	....	....	....	....	....	0.04
Panama	....	....	....	....	....	0.10	....	....	....	....	....	0.02	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.12
Richland	....	0.09	....	....	....	0.47	....	....	....	....	....	0.88	....	....	....	....	....	....	....	....	....	....	T	....	0.13	....	0.07	....	....	....	....	1.64
Rock Rapids	T	....	T	0.10	0.60	....	....	....	....	....	T	....	....	....	....	....	....	....	....	....	....	....	....	....	0.35	....	....	....	....	....	....	1.05
Seymour	....	0.22	....	....	0.11	....	....	....	....	....	0.87	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1.20
Sibley	T	T	T	0.12	0.12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.26	T	0.03	....	....	....	....	0.53
Sioux City	0.01	0.02	....	T	0.03	0.28	....	....	....	....	0.02	....	....	....	....	....	....	0.02	....	....	....	....	T	....	0.13	0 02	0.05	....	....	....	....	0.58
Spirit Lake	....	....	....	0.03	0.12	0.21	....	....	....	....	0.18	....	....	....	....	....	....	....	....	....	....	....	T	....	0.78	....	....	....	....	....	....	1.35
Storm Lake	....	....	....	T	....	....	T	....	....	....	T	....	....	....	....	....	....	T	....	....	....	....	....	....	....	0.02	0.08	....	....	....	....	0.10
Tipton	0.26	....	....	....	....	....	....	....	....	....	1 15	....	....	....	....	....	....	....	....	....	....	....	....	....	0.22	....	0.08	....	....	....	....	1.71
Vinton	0.57	....	....	....	1.11	....	....	....	....	....	0.72	T	....	....	....	....	....	T	....	....	....	....	....	....	0.13	....	0.04	....	....	....	....	2.57
Washington	....	0.08	....	....	....	0.40	....	....	....	....	....	0.55	....	....	....	....	....	....	....	....	....	....	....	....	....	0.12	....	....	....	....	....	1.15
Webster City	....	T	....	....	0.50	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	T	....	T	....	....	....	....	0.50
Williams	....	....	....	T	....	0 34	....	....	....	....	0.01	....	....	....	....	....	....	T	....	....	....	....	T	....	0.09	T	0.12	....	....	....	....	1 06
Winterset	....	....	....	....	....	....	....	....	....	....	....	0.15	T	....	....	....	....	....	....	....	....	....	....	....	T	....	T	....	....	....	....	0.15

STATIONS.	1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		Mon'y Mean.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	M	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Alta	74	58	50	42	66	32	60	41	56	42	65	40	68	43	85	46	78	44	82	62	52	42	54	34	63	37	50	32	56	20	76	40	71	45	69	45	57	34	72	34	75	37	79	54	68	30	48	26	53	33	48	30	55	28	35	17	42	15	62	28	69	49	62.6	37.2
Ames. (W.R.Cooper)	87	59	70	52	67	29	73	43	67	31	63	46	72	38	86	43	79	44	82	51	79	50	56	44	63	44	54	39	54	23	73	25	70	33	75	38	63	38	72	33	77	32	81	45	76	50	50	25	51	24	51	31	59	25	59	22	42	15	60	15	70	19	66	5.3	35.6
Amana	82	61	60	52	61	37	60	40	74	49	63	48	72	40	80	43	76	50	80	55	79	59	56	51	60	50	50	41	52	30	64	30	66	38	69	42	62	51	64	36	73	34	74	50	78	48	47	31	53	27	45	36	58	27	35	25	40	19	53	19	68	42	63.0	40.7
Audubon	80	57	59	38	71	28	71	43	66	42	67	48	73	45	84	41	83	50	80	60	72	45	58	37	64	34	51	34	56	22	73	39	71	43	73	47	60	37	71	33	71	43	79	49	75	37	68	32	55	30	50	34	51	29	40	18	46	21	61	22	70	49	66.1	38.0
Belle Plaine	84	61	62	50	61	33	61	40	74	51	63	47	71	56	79	44	76	53	81	58	77	54	56	48	60	50	51	38	51	27	65	32	65	38	71	43	62	43	65	30	74	37	75	48	77	42	47	30	56	28	46	29	61	26	37	24	40	17	55	14	67	43	63.5	40.1
Bonaparte	91	63	76	50	64	41	75	43	79	52	66	50	78	42	82	48	85	51	84	60	84	59	61	54	62	52	54	42	60	29	67	33	69	40	82	40	69	42	67	37	76	37	78	49	80	51	50	31	57	29	47	40	63	29	42	27	46	24	49	23	74	34	68.3	42.0
Carroll	78	50	55	38	64	30	63	41	68	50	67	43	64	48	87	47	81	45	82	60	82	48	54	38	61	34	62	36	69	21	78	38	72	40	58	42	72	32	70	40	72	42	74	58	72	40	58	20	48	31	48	32	42	30	37	18	46	22	58	22	60	48	63.9	38.2
Cedar Falls	80	60	67	52	67	35	65	41	77	43	70	46	74	45	85	40	84	45	84	52	86	58	75	56	65	39	62	38	59	30	65	30	69	32	69	41	72	36	77	36	78	33	77	50	77	48	62	27	52	27	49	38	60	26	35	24	42	15	54	19	66	42	67.7	38.5
Cedar Rapids	78	61	63	56	60	41	59	43	72	44	61	49	72	45	75	41	74	50	80	64	78	63	68	52	60	42	52	32	51	31	64	34	65	45	68	47	62	52	62	40	70	38	72	52	74	53	48	32	53	31	48	38	52	32	40	28	42	23	52	24	64	44	62.5	42.8
Centerville	81	61	60	40	70	42	72	44	71	41	70	45	75	48	73	47	71	47	72	46	65	41	64	40	63	39	68	38	65	37	70	37	60	41	75	45	71	39	75	39	80	45	78	50	80	30	63	32	61	32	52	29	65	25	48	35	62	35	70	36	73	38	68.8	39.8
Charles City	72	60	58	50	60	38	68	44	70	45	54	44	78	47	84	48	82	46	84	62	80	66	50	42	54	46	50	40	50	28	65	38	68	43	64	46	60	40	64	36	70	36	74	62	75	57	50	28	60	38	50	38	50	29	44	29	45	13	60	27	67	46	63.2	41.8
Clarinda	79	57	57	43	67	38	70	46	68	46	63	47	69	46	79	48	80	53	80	64	79	47	58	42	68	43	52	40	57	28	72	42	69	45	72	51	64	44	69	38	72	44	78	50	76	39	52	33	59	35	51	39	62	32	40	26	48	29	60	28	70	52	65.6	42.4
Corning	80	60	60	45	..	..	72	32	71	51	64	44	71	49	84	49	84	49	82	62	78	50	59	41	64	41	57	37	58	23	73	40	71	42	73	47	64	43	72	33	75	43	80	49	78	45	54	23	61	34	54	35	65	30	45	21	43	29	62	28	70	52	67.5	40.9
Cresco	68	54	55	44	60	40	63	40	66	46	59	43	66	37	77	45	71	46	81	55	76	48	54	44	59	46	45	38	53	28	66	33	66	42	67	43	56	38	64	40	73	35	73	50	74	35	44	25	49	28	43	28	57	25	32	22	37	14	50	17	63	41	60.2	37.7
Davenport	80	60	63	56	59	46	66	47	74	54	63	49	74	46	79	50	79	55	81	60	82	61	69	60	61	52	50	45	54	33	65	35	66	44	70	42	64	51	60	43	73	43	75	51	78	55	48	33	57	32	45	42	58	34	36	28	41	24	53	24	70	44	64.3	45.1
Decorah	69	51	59	41	59	40	63	44	70	49	58	36	69	44	78	43	74	56	82	62	79	46	57	50	59	41	46	32	64	34	66	43	68	42	69	45	56	42	62	34	75	54	76	59	80	28	46	24	51	37	43	27	57	23	38	16	33	14	51	21	63	32	62.2	39.4
Des Moines	86	64	54	50	67	35	64	44	74	48	64	48	74	47	86	48	84	56	82	66	81	53	58	46	64	50	52	41	55	28	72	37	71	45	74	49	63	46	72	39	76	44	80	53	77	48	52	31	51	32	52	40	61	50	40	24	42	22	61	24	70	52	66.5	43.2
Des Moines (5¼ miles southeast of)	85	65	73	50	65	36	62	45	74	46	68	48	73	46	83	49	84	53	84	53	81	55	55	46	64	49	61	39	54	28	71	35	70	44	71	49	54	46	69	35	79	45	79	53	77	50	54	30	55	30	50	40	63	28	44	24	43	26	60	24	71	50	67.3	42.5
Dubuque	73	57	61	56	59	43	58	44	74	50	61	52	74	42	79	47	74	51	82	54	80	62	60	51	60	50	50	43	56	36	65	33	68	43	72	43	65	52	57	42	73	39	76	51	78	52	47	32	53	30	46	40	58	32	36	28	41	23	51	22	66	44	63.0	43.4
Elkader	68	56	63	50	65	38	64	39	74	46	62	46	75	35	83	42	77	43	85	51	80	61	56	48	62	50	48	40	59	30	68	27	70	39	73	39	62	42	65	39	77	32	77	53	80	55	50	28	52	23	45	32	58	35	35	25	42	17	52	16	66	42	64.3	39.0
Emmetsburg	74	50	54	45	71	30	75	42	61	38	65	43	71	40	85	40	85	60	80	55	64	42	49	34	64	38	54	34	59	21	73	32	75	42	74	31	60	32	74	33	77	32	82	43	72	30	49	19	50	31	51	30	52	22	37	21	43	10	63	12	70	41	64.9	34.6
Galva	75	58	73	44	73	30	64	42	61	42	62	41	68	42	86	46	80	46	82	61	68	42	55	41	64	34	56	35	52	20	76	35	..	..	..	..	..	..	..	..	..	..	..	..	70	40	60	24	54	33	49	30	54	30	36	19	44	16	62	23	70	52	63	8	37.0
Glenwood	84	61	62	45	74	36	72	48	70	48	70	46	76	52	92	58	85	54	94	66	82	46	80	58	68	37	59	38	66	28	78	44	72	54	80	50	70	46	90	38	80	46	86	54	90	42	62	32	64	38	58	36	80	36	44	24	48	30	70	28	60	54	73	1	43.6
Greenfield	84	60	68	36	68	42	75	43	74	44	64	44	65	46	..	..	..	..	..	..	..	..	..	..	..	..	..	..	86	24	68	48	71	43	75	50	67	43	73	34	76	39	79	46	81	36	53	26	62	32	54	36	64	33	42	21	47	25	62	24	72	48	67.9	34.6
Grinnell	85	60	75	51	75	41	60	47	73	58	68	57	70	50	80	55	77	55	80	64	77	62	60	46	61	48	56	40	50	32	68	30	65	35	79	47	62	47	68	43	72	48	72	50	75	55	75	28	71	34	49	35	57	30	42	28	48	22	56	27	67	45	66.2	44.0
Grundy Center	85	52	60	35	65	42	62	44	70	48	63	40	72	45	83	45	75	50	82	57	79	44	55	44	62	38	50	26	54	27	69	38	68	40	69	42	61	35	68	35	76	44	77	50	77	26	49	28	52	34	48	27	61	23	37	16	40	16	56	23	68	39	64.3	37.5
Hampton	81	47	57	45	64	32	61	33	72	45	60	45	68	40	84	42	74	45	81	61	78	45	58	43	61	44	48	33	53	24	71	33	70	43	71	45	59	40	68	33	70	39	75	45	75	40	46	26	54	27	48	36	60	25	34	23	38	13	56	20	66	46	63.3	37.3
Hopeville	84	61	61	45	66	39	72	45	73	50	63	46	72	46	83	49	84	52	82	62	80	49	61	45	64	54	40	52	28	71	40	69	43	72	47	64	46	71	38	74	50	79	49	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	70.5	46.2
Independence	74	58	75	52	62	39	60	40	76	46	70	46	74	38	81	41	78	49	83	58	79	58	75	46	59	49	58	40	53	28	66	29	67	46	74	41	64	46	63	37	75	35	74	36	77	52	74	28	52	25	51	37	57	37	51	24	40	18	58	18	65	40	66.6	39.6
Indianola	86	65	89	50	67	34	64	45	74	50	68	48	73	47	83	48	83	54	82	63	80	60	72	46	59	58	47	44	71	37	70	43	73	49	..	..	..	..	64	62	69	67	65	74	77	50	52	29	55	40	51	39	61	30	39	36	42	20	61	25	70	55	67.6	47.1
Iowa City	82	61	60	56	64	42	61	40	76	50	70	48	75	39	81	43	79	49	83	61	81	58	74	54	62	51	57	43	55	31	66	29	69	40	74	41	63	45	64	35	77	32	78	46	80	49	74	32	55	25	52	42	61	25	52	26	44	22	55	19	70	40	67.5	41.1
Iowa Falls	85	60	51	45	65	31	63	37	74	54	64	43	70	39	82	43	75	48	82	59	..	..	55	42	62	43	48	34	53	23	71	33	71	43	59	39	69	39	72	35	74	33	78	48	23	51	27	48	29	36	21	40	11	..	..	..	..	..	40	11	52	19	66	45	62.0	35.9
Jefferson	..	..	85	40	70	30	70	43	70	43	70	45	71	42	..	..	..	..	85	45	85	65	85	50	60	40	65	45	60	45	..	..	70	30	75	25	75	45	75	38	75	35	75	40	80	50	80	58	60	25	55	35	50	35	60	35	60	20	60	20	70	45	..	..	70.2	39.9
Knoxville	87	63	58	50	63	36	60	46	73	48	71	47	76	48	82	47	82	53	82	63	83	59	54	47	63	49	50	40	50	27	70	34	68	43	72	45	62	49	68	39	75	45	76	52	76	50	52	30	54	29	53	38	62	30	39	36	42	19	59	27	69	49	65.5	42.8
Keokuk	90	66	64	55	64	46	75	50	77	53	65	52	78	50	83	54	86	58	83	61	83	61	66	54	64	53	52	54	45	54	30	67	37	68	42	71	44	71	49	66	41	76	41	78	49	81	51	51	34	57	33	47	41	62	35	42	30	46	27	57	28	74	43	68.0	46.0
Keosauqua	89	65	79	52	67	42	74	46	78	52	66	51	79	48	84	49	84	53	83	62	84	64	73	55	62	52	57	44	58	31	68	34	69	41	72	44	67	46	67	40	78	37	80	50	81	52	..	..	57	29	47	38	63	32	49	28	47	25	59	23	74	46	69	8	44.4
La Crosse (Wis)	71	55	58	52	58	46	62	43	69	47	58	49	68	39	79	47	73	46	84	53	79	52	54	45	66	48	48	44	56	35	67	35	70	46	70	47	61	46	61	42	76	46	76	55	76	80	50	46	32	52	29	45	58	30	30	39	30	42	19	50	20	66	44	62.5	41	9
Larrabee	74	56	60	37	71	28	60	40	56	38	63	40	66	46	84	44	79	44	80	59	60	37	60	32	63	32	51	31	57	21	77	29	70	46	70	39	59	31	74	30	74	32	79	42	60	32	51	19	49	35	48	28	53	36	38	18	44	13	60	18	69	50	63	2	34.7
Logan	68	61	64	44	76	32	74	45	72	48	66	46	71	45	81	52	86	50	85	62	76	46	76	38	65	52	55	38	66	22	76	44	76	50	78	50	76	42	80	41	84	54	61	49	65	35	70	34	65	35	66	22	62	40	44	24	50	32	64	30	74	48	69.9	41.9
Mason City	68	48	60	49	62	45	68	50	59	42	67	43	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	35	70	26	69	24	66	48	70	45	58	38	68	38	70	37	73	46	73	37	45	27	54	31	41	26	57	25	37	26	57	28	53	20	65	43	60.4	36.6
Mechanicsville	76	60	59	53	57	39	58	41	71	47	61	46	71	39	77	45	73	51	79	56	78	56	57	51	58	49	48	41	52	30	63	28	65	32	69	38	61	43	59	38	71	37	72	38	76	47	46	28	45	40	58	27	36	20	50	21	67	29	61	3.3	39.7
Omaha (Neb)	68	60	57	45	73	39	69	49	66	48	68	46	73	53	89	54	84	55	83	65	59	45	61	35	65	39	54	38	60	30	70	46	73	51	74	54	63	46	75	42	76	46	84	53	74	43	54	32	57	40	52	36	65	37	39	24	44	28	62	31	74	55	66.8	44.0
Oskaloosa	88	64	69	49	67	36	64	40	75	51	65	45	75	41	81	44	82	49	83	61	82	55	55	45	64	49	54	38	54	28	69	33	69	38	73	42	65	46	70	36	74	35	78	50	77	45	51	31	54	28	48	32	63	26	41	25	44	21	59	20	71	49	66.6	40.5
Panama	73	56	57	42	71	33	68	45	67	36	65	43	70	49	89	48	85	55	82	63	66	43	59	38	63	32	52	36	61	22	75	43	72	48	72	48	61	42	72	48	75	41	82	50	73	37	52	26	55	35	51	34	60	31	39	21	44	26	63	25	71	50	66.0	40.2
Rock Rapids	68	40	66	28	72	34	52	36	58	35	62	38	68	40	76	38	78	36	76	45	45	28	55	28	70	29	64	36	68	38	70	40	66	32	70	38	72	35	75	25	80	30	79	30	49	42	51	18	42	30	42	25	49	32	30	18	50	15	59	25	74	39	62.6	32.4
Seymour	87	63	80	48	68	35	73	43	77	48	71	45	74	44	81	47	85	53	88	58	84	56	65	46	63	47	57	39	57	26	70	34	70	34	72	43	67	45	70	38	75	40	78	45	75	50	30	15	55	15	53	20	60	15	54	20	60	28	60	18	70	40	69.3	38.0
Sioux City	64	52	52	42	74	37	62	46	58	41	68	42	66	51	86	51	83	49	75	64	56	41	60	27	66	32	54	35	59	21	78	43	71	50	68	37	64	56	77	37	76	35	79	53	46	36	53	26	46	39	50	27	58	36	55	22	43	25	62	28	73	52	63	3	39.1
Spirit Lake	76	64	54	42	72	30	53	39	54	36	64	42	71	37	83	42	75	45	82	57	60	35	50	32	63	38	49	29	51	21	76	37	72	36	72	42	58	52	76	32	72	26	82	46	66	29	49	17	43	34	49	26	53	18	58	29	40	12	62	18	62	48	62.8	35.2
Storm Lake	72	51	60	44	67	37	60	45	70	40	61	43	68	48	81	48	77	49	79	62	72	44	52	35	61	45	56	35	58	25	73	38	70	48	71	45	61	37	73	37	73	37	77	54	72	41	50	24	53	41	48	33	53	33	39	19	44	17	59	37	61	50	63	3	40.1
Tipton	80	60	61	42	61	42	61	41	75	51	..	..	..	..	..	..	..	..	..	..	..	..	..	..	68	43	49	31	55	33	65	37	67	41	68	39	72	40	62	39	..	..	..	..	..	..	70	40	49	28	55	40	45	30	59	26	37	21	42	24	53	43	..	..	59.7	37.7
Winterset	86	65	55	50	68	34	68	42	74	43	63	46	73	43	85	48	84	54	86	64	83	60	55	45	66	44	53	40	57	27	74	40	74	45	77	49	64	43	73	35	79	45	81	50	78	50	52	29	57	30	52	38	65	28	42	25	42	22	64	25	70	51	67.4	42.2

IOWA PRECIPITATION CHART OCTOBER 1893.



MEAN TEMPERATURE OCTOBER 1893.



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Alta	D. E. Hadden.
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Ames	E. C. Dickinson.
Ames	W. H. Helleman.
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Audubon	J. F. Hocker.
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Walnut	F
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UNITED STATES DEPARTMENT OF AGRICULTURE
WEATHER BUREAU.

MONTHLY REVIEW

OF THE

Iowa Weather and Crop Service.

VOL. IV.—NOVEMBER, 1893.—NO. 11.

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LOCAL FORECAST OFFICIAL,
U. S. WEATHER BUREAU, ASS'T DIRECTOR.

DES MOINES:
G. H. RAGSDALE, STATE PRINTER.
1893.

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MONTHLY REVIEW

OF THE

IOWA WEATHER AND CROP SERVICE.

VOL. IV.] NOVEMBER, 1893. [No. 11.

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IOWA CROP REPORT, DECEMBER, 1893.

ROUND-UP CROP REPORT OF THE SEASON, TABULATED FROM REPORTS OF CORRESPONDENTS REPRESENTING EVERY COUNTY IN THE STATE.

AVERAGE YIELD PER ACRE AND MARKET PRICES OF STAPLE CROPS.

The round-up of the season shows, that, while the total products of the soil in Iowa fall somewhat below an average, yet the farmers of this State have abundant cause for devout thanksgiving. Considering the unfavorable beginning of the planting season and the severe drought of the summer and autumn, the total output of the harvests is gratifyingly large, giving a most striking illustration of the productiveness of this region.

CORN—The average yield of this leading crop of the State is shown by the reports of over seven hundred correspondents to be thirty-five and seven-tenths (35.7) bushels per acre. This is about three bushels per acre above the average of the past fifteen years. The number of acres planted this year in Iowa, as shown by the reports of assessors and correspondents, was 6,016,940; indicating a total yield of 214,804,758 bushels, which is over 40,000,000 in excess of last year's product. The average market price December 1st was 25 cents a bushel.

WINTER WHEAT—The area of winter wheat harvested this year was 233,553 acres. The average yield was 15.4 bushels per acre, giving a total product of 3,690.137 bushels,

SPRING WHEAT—Average, 12.4 bushels per acre; acres harvested, 620,626; product, 7,695.762 bushels. Total winter and spring wheat yield, 11,385,899 bushels. Average price, 49 cents.

OATS—Acreage harvested, 4,197,623; average yield, 28 bushels per acre; total product, 100 742,852 bushels. Average price, 22 cents.

RYE—Average per acre, 16 3 bushels; area harvested, 109,528; total product, 1,785,202 bushels. Average price, 35 cents.

BARLEY—Average per acre, 22.3; number of acres, 506,091; total product, 11,437,666 bushels. Average price, 32 cents.

FLAX—Average per acre, 9.1; number of acres, 248,776; total product, 2,263.861 bushels. Average price, 86 cents.

BUCKWHEAT—Average per acre, 13.8; acres harvested, 31.042; total yield, 428,379. Average price, 63 cents.

IRISH POTATOES—Average per acre, 59.2; acres planted, 104,261; total product, 6,172,257 bushels. Average price 66 cents.

SWEET POTATOES—Average, 64.8 bushels; total yield, (estimated) 180 440 bushels. Average price, $1.40.

TIMOTHY SEED—Average yield, 4 bushels; acreage 164,104 acres; total product, 656,416 bushels. Average price, $1.40.

CLOVER SEED—Average yield, 2 bushels per acre: total area, 54,538; product, 109,076 bushels. Average price. $5.48.

MILLET SEED—Average per acre, 19.3 bushels; acreage, unknown.

SORGHUM—Average yield, 85.6 gallons per acre; area planted, about 6,517 acres; yield, 557,855 gallons. Average price, 46 cents.

BROOM CORN—Number tons raised, 1,735; average price, $63.65.

HAY—Average yield, 1.7 per acre; acreage, exclusive of prairie hay, 2,687,858 acres; total product, 4,569,341 tons. Average price, $5.22 per ton.

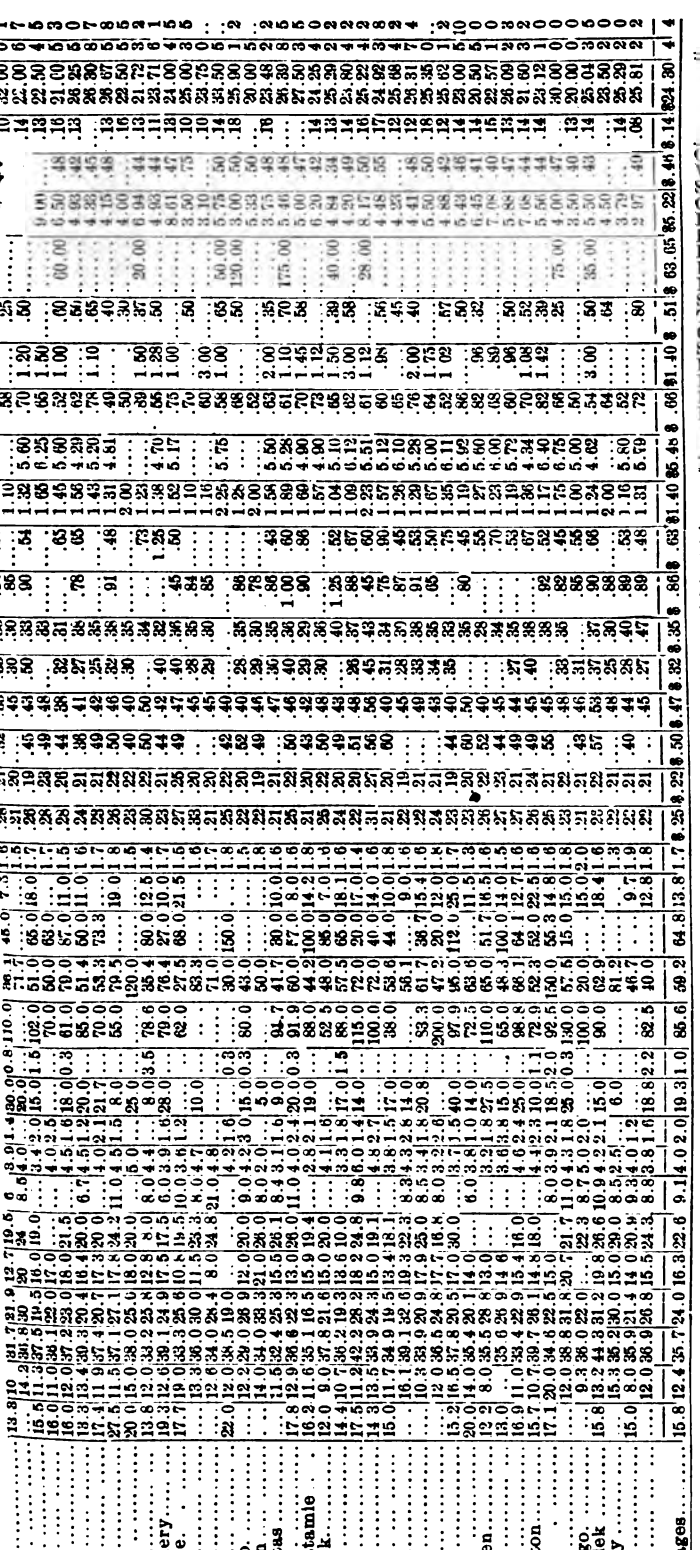
PRAIRIE HAY—Estimated average yield per acre, 1.4 tons; acres cut, 2,009,403; total product, 2,813,164 tons. Average price, $3 per ton.

OLD CORN AND OATS—The average amount of old corn (crop of 1892) in farmers' hands is 4 per cent—approximately, 6,000,000 bushels. The average amount of last year's oats on hand is also about 4 per cent.

WOOL—The average price of wool is 14 cents per pound.

MILCH COWS—The average price of milch cows is $24.30 a head.

COUNTIES.	AVERAGE YIELD PER ACRE BY COUNTIES.																AVERAGE MARKET PRICES AT NEAREST STATIONS.																	
	Winter wheat, bu.	Spring wheat, bu.	Corn, bu.	Oats, bu.	Rye, bu.	Barley, bu.	Flax, bu.	Timothy seed, bu.	Clover seed, bu.	Millet seed, bu.	Broom corn, tons.	Sorghum, gallons.	Irish potatoes, bu.	Sweet potatoes, bu.	Buckwheat, bu.	Hay, tons.	Corn, bu.	Oats, bu.	Winter wheat, bu.	Spring wheat, bu.	Barley, bu.	Rye, bu.	Flax, bu.	Buckwheat, bu.	Timothy seed, bu.	Clover seed, bu.	Irish potatoes, bu.	Sweet potatoes, bu.	Millet seed.	Broom corn, ton.	Hay, ton.	Sorghum, gallon.	Wool, pound.	Cows, per head.	Per cent old corn.	Per cent old oats.
Adair	19.4	11.6	35.9	21.1	15	40	...	3.8	1.6	17.5	...	160	75.7	...	20	1.6	$.21	$.22	$.49	$.50	$.25	$.30	$....	$ .70	$1.28	$5.17	$ .66	$1 25	$ .57	$ 30.00	$5 08	$ .48	$ .14	$22.28	6	10
Adams	17	12	35.8	22	15	15	....	4	1.9	15	...	138	110	200	....	1.8	.24	.21	.50	.50	....	.32	.50	.....	1.25	5.50	.60	.75	.30	.....	4.50	.40	.09	31.00	10	..
Allamakee	18	11	40	33	20	26	10	5	1.8	....	...	92	68	....	12	2.1	.28	.22	.50	.45	.36	.35	.90	.60	1.12	4.62	.45	....	.....	.....	5.25	.45	.11	20.75	2	5
Appanoose	12.7	....	29.5	25.1	15	....	7.3	4.2	2.7	10	...	150	36.3	66	15	1.9	.32	.20	.52	....	....	.43	.95	.60	1.22	4.75	.89	1.28	.80	.....	6.21	.43	.13	21.67	..	..
Audubon	18.6	11.8	30.8	22.8	15	21.8	9.5	4.3	2.4	12	...	70	67	100	16	1.7	.21	.19	.40	.39	.32	.32	.92	1.00	1.17	5.00	.62	1.65	.75	.....	4.50	.45	.16	25.00	8	5
Benton	27	13.8	34.8	27	12.2	23.3	....	2.8	1.9	....	...	....	92	....	....	1.8	.26	.23	.47	.46	.35	.35	.90	.....	1.41	5.50	.68	....	.....	.....	5.70	.45	.12	25.20	6	1
Black Hawk	....	14	33.8	27	12.5	27.5	15	3.8	2.2	15	...	120	58.3	60	10	1.9	.24	.24	....	72	.40	.35	.80	.40	1.35	6.25	.65	1.50	.62	.....	5.83	.42	.13	26.40	6	..
Boone	13.5	13.4	35.7	28.2	16.2	8	8.5	2.6	1.7	17.1	1	105.5	55.6	80	11.1	1.8	.22	.21	.46	.48	...	.37	.84	.59	1.71	5 50	.78	1.00	.77	20.00	4.18	.45	.15	23.97	8	7
Bremer	....	12.5	30	23.2	16	....	7	5	2	....	...	40	40	....	11.5	1.6	.24	.22	....	.58	....	.37	.78	.68	1.24	4.92	.62	.....	.....	.....	5.50	.45	.02	27.25	1	1
Buchanan	....	....	35	22	....	....	....	4	2.5	....	...	80	60	....	....	1.5	.25	.22	....	....	....	....	....	.....	1.25	5.50	.40	.....	.....	.....	5.00	.40	.17	18.00	2	..
Buena Vista	...	11.2	37	24.6	14	19	8	4.3	1	20	...	....	85	....	10	1.4	.21	.20	....	41	.27	.25	.81	.....	1.03	5.31	.50	.....	.23	.....	3.50	.45	.12	24.90	3	3
Butler	....	13.2	32.7	24.1	16.3	22.6	9.2	3.9	2.7	21.2	...	45	75.8	60	18.2	1.8	.25	.22	....	.53	28	.36	.81	.60	1.22	5.42	.69	2.40	.42	.....	4.67	.42	.14	25.93	6	5
Calhoun	....	11.6	35.5	23	17.6	23	8.6	5.2	1.5	22.5	...	100	54.1	....	15	1.5	.21	.20	....	.50	.30	.31	.85	.45	1.50	6.00	.63	....	.38	.....	2.37	.45	.11	23.66	5	10
Carroll	15.2	13.6	38.7	23.1	17.5	20.5	10.5	3.6	2	21.2	...	58	65.4	15	10	1.9	.22	.20	.48	.43	.33	.32	.80	.50	1.50	5.50	.56	.60	.45	.....	3.58	.48	.20	22.50	3	6
Cass	20.5	11.5	33.2	18.7	16	25	....	2.1	1.6	9.6	1.2	88.3	63.7	40	18	1.7	.22	.20	.40	.38	.30	.33	.....	.30	1.56	4.68	.53	1.00	.40	80 00	4.87	.43	.13	25.33	2	10
Cedar	11.6	13	36.2	23.7	13.2	20.3	12	4.6	2	....	...	85	51.7	20	12	1.4	.26	.23	.46	.49	.40	.48	1.00	.45	1.38	5.62	.70	1.00	.....	.....	6.83	.45	.13	22 60	..	..
Cerro Gordo	....	12	35	25.7	15.5	24	9.2	3.9	1.5	19	...	35	53.3	.....	16.6	1.5	.25	.22	....	.58	.29	.30	.90	.51	1.22	5.33	.59	.....	.65	.....	4.20	....	.13	27.83	9	6
Cherokee	....	15.2	37	33.8	13.3	27.5	10	4	....	40	...	....	61.2	.....	10	1.5	.22	.20	....	.46	.30	.30	.95	.65	.95	....	.62	.....	.75	.....	4.88	....	....	22.75	7	5
Chickasaw	15	11.2	28.6	24.6	20	21.3	7.9	3.3	1.6	....	...	68	57.5	.....	10.8	1.7	.25	.22	.50	.49	.29	.30	.87	.48	1.17	4.75	.56	.....	.....	.....	4 22	.49	.14	25.69	1	..
Clarke	12.2	....	35.5	19.1	13.3	15	....	4	2.6	6.5	...	81	46	....	12	1.5	.24	.21	.48	....	.35	.33	1.25	.45	1.17	5.33	.79	2.27	.40	.....	5.95	.45	.12	22.25	5	..
Clay	11	17.2	38	24	18.2	21.7	7.5	3.8	....	18.3	1	40	51.7	.....	15.7	1.6	.21	.20	....	.46	.28	.32	.84	.45	1.15	5.00	.63	.....	.35	35.00	3 25	.50	.16	26.50	4	9
Clayton	13	16.5	43	35	18.5	24	....	3.5	2.8	....	...	65	65	....	12	1.6	.27	.24	.58	.64	.36	.35	.....	1.00	1.68	6.00	.55	.....	.....	.....	6.50	.39	.16	24.50	2	5
Clinton	15	10	44.3	21	40	40	....	3	1.6	....	...	....	43.3	.....	....	1.7	.28	.27	.65	.60	.30	.40	.....	.....	1.25	5.00	.57	.....	.....	.....	9.00	....	.13	20.33	2	3
Crawford	20	14 6	41	26	19	24.5	8	4.5	3.1	25	...	53.3	84	40	25	2	.23	.20	.46	.45	.29	.30	.80	1.10	1.58	5.02	.59	2.00	.37	.....	5.12	.40	.10	26.25	4	1
Dallas	16	12.8	38.7	23	15.3	....	13	3.3	2.2	16.3	...	90	53.3	50	14	1.9	.24	.21	.47	.42	....	.40	1 00	.67	1.55	5.70	.77	1.62	.52	.....	4 67	.48	.16	25.90	8	..
Davis	12	....	32.8	25.8	11.4	....	....	3	3	20	...	65	35.2	61.7	10	1.3	.30	.21	.44	....	....	.39	....	.60	1.30	5.50	.76	1.36	.35	.....	6.40	.45	.14	22.00	8	6
Decatur	13.5	10.3	35.3	21	13.6	....	8	3.9	2	10.3	...	77.5	56.1	50	16.4	1.6	.24	.19	.51	.48	.35	.37	.90	.74	1.30	5.50	.75	1.78	.41	.....	4.68	.38	.13	21.86	2	2
Delaware	15	13.8	36	26.7	16.8	25.3	....	4.5	1.9	10	...	115	88.1	....	14	1 5	.28	.23	.62	.53	.37	.42	.75	1.00	1.48	5.70	.58	.....	.50	.....	5.38	.43	.14	23.58	4	..
Des Moines	12	8	32	27.7	15.7	....	....	3.5	2.2	....	...	75	76.7	78	5	1.6	.28	.25	.55	.55	....	.47	.....	1.00	1.75	5.00	.82	1.25	.....	.....	9.33	.50	.23	23.00	10	..
Dickinson	....	10.3	31	27	20	24	8.7	4.5	....	40	...	....	41.7	.....	....	2.2	.21	.20	....	.43	.26	.26	.87	.....	1 20	.....	.63	.....	.70	.....	3.25	....	.12	26 67	5	..
Dubuque	10	9.8	35	29.8	14.5	29	....	4.2	1.6	....	...	40	58.8	.....	11	1.5	.28	.26	.52	.49	.42	.40	1.06	.62	1.38	6.25	.70	1.00	.....	.....	7.31	.40	.11	20 50	2	3
Emmet	....	11	33.8	25	11	22.8	8.5	4	2	....	...	60	43	.....	5	1.8	.20	.16	....	.44	.26	.28	.85	.70	.95	5.00	.70	.....	.....	.....	2.50	.50	.12	24.33	10	5
Fayette	15	7.5	30.7	28.6	18.2	23.8	8	5	3.9	18	...	60	67	.....	14	1.7	.25	.22	.83	.45	.28	.32	.77	.81	1.31	6.50	.53	.....	.35	.....	4.36	.43	.17	24.83	1	2
Floyd	18	10	32.6	22	17.5	25	9.2	2.4	1.5	16	...	78	68	.....	18	1.7	.25	.21	.57	.48	.28	.38	.84	.58	1.23	6.17	.50	.....	.62	.....	4.10	.40	.15	26.20	6	5
Franklin	....	11.5	33.9	24.7	26	27.2	9	3.6	1.3	40	...	70	62.9	..	14	1.9	.22	.22	.45	.43	.28	.40	.85	.58	1.22	5.17	.59	.....	.40	.....	3.71	.50	.13	22.00	4	2
Fremont	17.5	10.7	33 9	20	19	....	....	4	2 5	15	...	....	55.5	50	....	1.8	.23	.20	.46	.42	..	.32	.....	.....	.....	8.00	.75	.....	1.00	.....	4.62	.45	.20	21.67	7	2
Greene	17 5	9	36.7	25 3	45	27.5	8.2	3.1	1.7	25	...	90	53.3	12	12	1 5	.22	.24	.43	.48	.32	.50	.85	.52	1.38	7.00	.56	1.75	.....	.....	3.75	.45	.14	22.67	..	..
Grundy	....	13.3	35.7	24.9	19.6	28 9	10.3	4.4	1.8	10	..	50	66 4	....	14 5	1.8	.23	.22	....	.46	.35	.35	.90	.53	1.32	5.50	.59	.....	.50	.....	4.54	.48	.15	26.36	5	6
Guthrie	12.2	10.6	30	17.9	13.2	18	6	2.7	1.8	18.3	..	81.2	45.2	45	11.6	1.9	.22	.21	.47	.45	.34	.32	.86	.62	1.26	5.00	.68	1.33	50	.....	4.27	.45	.14	21.30	2	6
Hamilton	....	16	41.6	23	20.5	19	7	3.7	1.4	10	...	80	52.5	30	13.5	1.7	.24	.22	....	.48	.25	.32	.88	.58	1.32	5.75	.69	2.75	.....	.....	3.75	.48	.13	24 56	3	1
Hancock	....	11.6	31.6	22 3	18	20.9	8.4	4.1	1.5	23.8	...	80	38.8	.....	23.3	2	.22	.22	.45	.44	.28	.35	.86	.60	1.57	5.19	.66	....	.38	.....	2.82	.50	.11	23.78	2	10
Hardin	....	11	31.8	25	15.8	20.4	8	3.9	1.6	20	0.3	67.6	61.6	22.5	9 6	1.8	.23	.22	.50	.48	.37	.35	.88	.61	1.92	4.25	.72	.....	.45	60 00	4.11	.50	.15	25.62	4	5
Harrison	16	11.5	30.6	21.4	18.6	15.7	...	3.3	1.7	21.5	...	212.5	39	275	12.5	2.1	.23	.20	.53	.48	.33	.37	.....	.77	1.38	4.87	.85	1.00	.39	.....	4.40	.47	....	21.60	4	2
Henry	12.5	....	36.4	28.4	14.6	....	....	4.4	2.9	....	...	62.5	68.8	55	....	1.5	.30	.28	.50	....	....	.36	.....	....	1.31	5.60	.58	.95	.....	.....	7.80	.40	.14	23.00	5	2
Howard	12.2	13.2	34.8	30.2	14.8	25.8	10.5	4.4	2.3	8	...	50	61.9	.....	9.5	1.6	.26	.22	.45	.50	.34	.38	.89	.61	1.20	5 06	.49	.....	.30	.....	4 50	.50	.14	29.05	3	1
Humboldt	....	12.5	36.8	27.9	15.7	20.7	8.5	3.8	1 6	4	0.3	66.2	61.7	.....	13.3	1.5	.23	.21	....	.44	.28	.32	.84	.50	1.40	5.70	.64	.....	.80	60.00	3.61	.45	.13	28.50	3	2
Ida	14 5	15.2	39	20 4	19	23.8	7.5	4.8	1 1	20	...	....	66.6	.....	....	1.6	.22	.20	.42	.43	.29	.27	.82	.....	1 58	6.70	.67	.....	.45	.....	4.90	....	....	31.00	6	..
Iowa	14	15	36.4	25.6	16	....	4.8	4.8	....	....	...	137.5	37.5	100	....	1.9	.26	.22	.59	.55	....	.38	.....	.60	1.15	6.00	.76	1.20	.....	.....	7.15	.47	.13	23.00	7	12
Jackson	15.2	13.5	35.4	27.2	16.2	25	....	6	2.6	20	...	95	35	....	16.7	1.5	.29	.25	.51	.43	.50	.36	.....	93	1.72	4.75	.74	1.45	1.00	.....	7.95	.49	.20	21.88	3	2
Jasper	13.3	11.5	39.2	23.6	17.6	25	....	3	2	....	1.5	104	74.2	75	12.5	1.7	.25	.22	.50	.45	.30	.33	.....	.76	1.50	6.28	.55	1.50	.....	120.00	6.21	.48	.15	28.12	7	10
Jefferson	11.8	8.7	35	25.5	13	23.3	....	3.1	1.5	25	0.5	76	57	57	9	1.5	.28	.23	.50	.50	.35	.37	.....	.....	1 20	5.32	.78	1.08	.40	80.00	7.25	.42	.14	21.00	4	5
Johnson	16	13	37.6	24	16	30	....	4.4	1.6	12	0.3	97	46.6	66.7	8	1.5	.26	.24	.49	.48	.28	.37	.....	.....	1.10	4.50	.70	.96	.48	60.00	7.00	.37	.18	21.00	4	5
Jones	....	14	45	29.5	16 3	31.3	....	4.5	1.4	....	...	105	80	....	14	1.6	.30	.25	....	.60	.40	.46	.....	.83	1.50	6.67	.76	.....	.....	.....	6.50	.40	.11	24.50	2	3
Keokuk	22	17	37 5	24.2	19.7	15	22	3.8	....	....	...	95	58 4	75	....	1.6	.26	.24	.54	.49	....	.40	.....	.....	.....	.....	.....	.....	.....	.....	6 00	.....	.....	.....	.....	.....
Kossuth	....	9	30.5	26	....	32	13	4	....	....	...	....	35	....	....	1.2	.20	.18	....	.45	.20	....	.35	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Lee	12.2	....	31.6	27.8	12	....	....	2.7	2.1	30	...	84	50.7	56.2	17.5	1.3	.26	.22	.50	....	....	.43	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Linn	16.3	14	41.3	30.5	17	20	....	7.5	3.2	....	1.5	90	44.2	....	16	1.8	.28	.23	.51	.48	.50	.35	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Louisa	13.8	12	35	26.2	17	28	....	4.0	1.8	14.0	...	75	42.5	70	....	1.4	.27	.25	.48	.42	.32	.33	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....



GENERAL CROP SUMMARY, 1893.

PRODUCTS.	Number of Acres	Average per acre	Total product	Market value Dec. 1
Corn	6,016,940	35.7	214,804,758 bu	$ 53,701,189
Winter Wheat	233,553	15.8	3,690,137	1,845,068
Spring Wheat	629,626	12.4	7,695,762	3,617,008
Oats	4,197,023	24	100,742,852	22,163,427
Rye	109,528	16.3	1,785,102	621,820
Barley	506,091	22.6	11,437,656	3,669,049
Flax	248,776	9.1	2,263,861	1,946,920
Buckwheat	31,042	13.8	428,379	269,878
Irish Potatoes	104,261	59.2	6,172,251	3,963,885
Sweet Potatoes	28,000		181,440	254,016
Timothy Seed	164,104	4	656,416	918,972
Clover Seed	54,598	2	109,076	497,736
Sorghum	6,517	85.6	557,855 gls	256,613
Hay	2,687,848	1.7	4,569,341 t'n	23,850,959
Prairie Hay	2,009,403	1.4	2,813,164	8,439,492
Broom Corn			1,735	110,432
Pasturage				*35,000,000
Total				$ 161,207,464

*Estimated value.

In the above summary no account is made of the products of the orchards, vineyards and gardens which amount to a considerable sum. The total yield of farm crops exceeds that of last year, but the average market prices on December 1st were materially lower than on the corresponding date in 1892. The actual value of the soil products of the State is by no means to be estimated at the current market prices December 1st, which on that date are usually lower than at other seasons of the year. And there is generally a large increase in value in using these products as raw material in the manufacture of pork, beef, butter, poultry, sheep, horses, etc. It would be safe to estimate the total value of all soil products of this State for the year 1893, in round numbers, at $200,000,000.

EDITORIAL NOTES.

The annual report of Secretary Morton, of the U. S. Department of Agriculture, recently submitted to the President, states that the work of the Weather Bureau has been carried on with improved efficiency and economy, a reduction in cost of maintenance of nearly 10 per cent being effected and estimates for the fiscal year being correspondingly reduced. A re-organization of the bureau has been partially effected, designed to modify expenses and magnify the value of the service to agriculture, commerce and the people at large. The attention of the force has been fixed more strongly than ever before upon the work of forecasting as a primary duty of the bureau to the public. Especial efforts have been made to improve the river-flood service and to increase the efficiency of the storm-warning system on the Great Lakes. The wide and more immediate distribution of the weather maps is the subject of earnest effort which it is hoped will be successful. Full forecasts are now received at 1,622 stations, while nearly 5,000 places receive them gratuitously, an increase of 1,000 during the past year, which it is hoped to further increase in the near future by 1,500 or 2,000 without further expense to the government. A system of exchange

with the department and the Central Meteorological Observatory of Mexico is announced on terms similar to those in operation with Canada, while the desirability of full telegraphic reports from the Bahamas is emphasized.

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The principal object of the international exposition to be held in Vienna next year, lasting from April 20th to June 10th, is to present a complete exhibition of all sorts of food products, whether fresh or preserved—chiefly all kinds of meats, vegetables, dairy and baker's products, as well as different methods of salting and pickling. Rational methods of bread-making and preparing food in large quantities will be in actual operation. Popular lectures will be given, accompanied by experiments with a view to comparing the relative merits of the food preparations. In the Department of Army Maintenance the exhibits will show all particulars connected with the sustenance of troops in compliance with the requirements of military life, such as easy transportation, quick production, and extent of nutritive power. Secretary Morton has advised the special representative of the Department of Agriculture in central Europe to proceed to Vienna in ample time to receive and superintend the installation of exhibits of food products, which may be sent from this country. In the absence of a special appropriation for the purpose he can not undertake representation on an extensive scale involving special commissions and large expenses, but the representative now in central Europe, Hon. John Mattes, jr., will receive all goods that American manufacturers may desire to exhibit, and will endeavor to insure their installation in the best manner possible. Mr. Mattes has already advised the Department that the inquiries made by him lead him to anticipate a very successful exhibition, and he is of the opinion that it would be of great advantage to our food manufacturers to be well represented thereat. Many of these large manufacturers would doubtless find it profitable not only to exhibit their wares at such an exhibition, but to send a representative. Under any circumstances Mr. Mattes, who is perfectly familiar with the German language, will do his best to serve the interests of all intending exhibitors. A cablegram forwarded by him to the Department November 27th announces that the date up to which entries may be made by American exhibitors has been extended to February 1, 1894.

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French scientists have recently undertaken to investigate the upper air by means of light-weight balloons carrying self-registering instruments. At their first experiment the balloon reached the unprecedented altitude of nearly 17,000 metres, or about ten and a half miles, and came back to earth within a few hours with its important freightage unharmed. The barometric record showed an atmospheric pressure of only three and three-quarter inches—indicating that seven-eighths of the earth's atmosphere, in weight, lie below the region reached by the balloon. The self-registering thermometer showed a temperature of 60 degrees below zero, while the mercury at the earth's surface stood at 62 above.

The annual report of Dairy Commissioner Tupper states that during the year, ending September 30, 1863, the shipments of Iowa butter amounted to 52,549,448 pounds. The home consumption amounts 100,000,000 pounds, making a total production of about 152,000,000 pounds, valued at $33,550,000, estimated at the low average of 22 cents per pound.

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At the World's Fair Iowa creamery butter scored higher in the four tests made in June, July, September and October than the butter of any other state or nation. We received 128 awards, with diplomas stating the degree of excellence of the exhibits.

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Ponds and streams are unusually low, and this fact will necessitate extra care in cutting ice for the coming summer. Ice from shallow water may serve a good purpose for cold storage, but it should not be put into drinking water.

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Somewhat more than an average amount of late fall plowing has been done in Iowa this year. Corn has never been cribbed in better condition for shelling or keeping.

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December came in wrapped in snowy robes, the entire State being covered with snow on the second day of the month to the depth of 12 to 18 inches, with temperature as low as 16 degrees below zero at northern points.

HORTICULTURE FROM A CLIMATIC STANDPOINT.

A PAPER READ BEFORE THE IOWA HORTICULTURAL SOCIETY NOV. 23, BY J. R. SAGE.

Iowa is unquestionably the foremost agricultural State in the Union. It easily distances all other states in the production of corn, and has notable adaptability of soil and climate for the growing of all staple crops. All the elements—heat and cold, sunshine and frost, Arctic winters and tropical summers—contribute their quota to increase the volume of production. The only drawbacks experienced are the results of occasional excess of some of the benign elements which in their normal operation make this region a paradise of abundance.

This society represents a body of men who are striving to make Iowa notable in the line of horticulture as well as agriculture, and is gratifying to know that a fair measure of success has been achieved. The honors won at the World's Fair by the exhibit of Iowa fruits attest the fact that the people of this State are not devoting all their time and energies to the culture of the grosser products of the soil. Iowa horticulture is steadily advancing and there is promise that in the not distant future the orchards, vineyards and gardens of this State will produce more than enough of the staple fruits for the wants of our own people.

But this is by no means an easy undertaking, for it must be admitted that the climate of Iowa and of the Upper Mississippi valley generally, is much better adapted to agriculture than horticulture. It requires a much greater expenditure of gray matter or brain fertil

izer, or a higher order of talent, to raise an abundance of fruit than to produce vast quantities of hog and hominy. The farmer scratches the back of old earth with harrow and cultivator, and an abundant harvest is assured. But the fruit grower must needs contend against many adverse conditions of which the corn grower has no conception. Eternal vigilance is the price of the best fruits of earth as well as of liberty. And despite the exercise of the most intelligent care and vigilance the fruit grower will have many "off years" and suffer many grievous disappointments. All the more honor to those who hold fast and win a fair measure of success in the end.

It were too much, perhaps, to expect a State to possess all the cardinal virtues, and some may contend that we ought to be satisfied to have Iowa stand foremost in agriculture. But we are not content with that alone, and that's what we are here for. We believe, and, in fact, we know that Iowa possesses vast undeveloped resources in the line of fruit production. To develop these resources is our duty, and the fact that great obstacles must be overcome adds honor to achievement.

Climate is the prime factor in fruit culture. A poor soil may be improved, but general climatic conditions can not be materially changed by human agency. The best we can do is to mitigate severity and breed plants of sufficient hardiness to withstand the extremes incident to our climate. This has been done to some extent in Iowa, and along this line future success must be won.

The climate of Iowa is strictly continental, and this implies that it has cold, dry winters and warm summers, with great seasonal and daily ranges of temperature, a generally dry atmosphere and a large percentage of sunshine. Having no considerable body of water to store up heat and serve as an equalizer of the seasons, it takes a pretty long thermometer to record the extremes of temperature. And this liability to extremes is the one feature of the climate which the fruit-grower must take into account.

In our climatic studies we take note of averages and do not pay sufficient heed to the extremes which so vitally affect plant life and growth. At many points in Iowa the records show a range of 125° to 130° from the maximum of summer to the minimum of winter, and a monthly range of 50° to 75°. At Des Moines, in the year 1892, the maximum temperature recorded was 95° above and the minimum 26° below zero. In January of that year the maximum was 50° above, the minimum 26° below—a range of 76° for the month. At Los Angeles, Cal., the weather bureau records show an annual range of 60° to 70°, the maximum reaching about 90° to 95°, and the minimum seldom going below 30°.

So our Iowa horticulturists must face the fact that their unprotected trees and vines are subjected to below zero temperature a good many days during the winter months. In the northern tier of counties the mean temperature of each month in the year is 8° to 10° lower than at southern points. And in the northern counties 30° below zero is not an uncommon figure in the mid-winter season. Only well-ripened and hardy vines and trees can successfully carry their fruit buds through such a low degree of temperature, especially when the air is almost destitute of moisture.

But the variableness of our winter and spring months is the climatic feature which is most trying to plants as well as people. We have occasional warm spells near mid-winter when the bright sunshine and balmy air cause the sap to flow and buds to swell, and the soil is in good condition to plow; then the wind suddenly veers to the north, bringing boreal blasts and zero temperature, more severe in effect because of the sudden change. A steady cold winter is not so damaging as one of the open-and-shut variety.

And as a rule, it may be stated, our winters are not so destructive to fruit buds as the spring months. The last week of March, 1893, was warm and genial, with maximum temperature ranging from 60° to 75°, and the minimum barely reaching the freezing point. The first decade in April gave a mean daily temperature of 53°, the maximum on several days reaching above 80°; the daily mean of the second decade was 44°, with a minimum of 22°, at Des Moines; and the third decade brought a daily mean of 40°, with minimum records from 21° to 26°. The last day of April was colder than the first day, and the average of the last decade was 13° lower than the mean of the first decade. The month came in wrong end foremost.

The first decade in May gave a daily mean at Des Moines of 50° (8° lower than the first decade of April) with a minimum reaching the frost line at many points in the State on the 2d, 3d, 4th and 6th. And there were frequent cold rains with heavy gales during the season of blossoming and pollination. Thousands of spring pigs were destroyed by excessive cold and moisture, and it seems a miracle that any tender buds survived to make an exhibit at the great exposition.

The springs of 1892 and 1893 were alike unfavorable—twins of a sinister breed. Happily our State is not burdened by a very large family of that sort. Probably more than half our seasons are fairly mild and favorable for the trees and vines that are hardy and well acclimated.

But our horticulturists must run the gauntlet, and take their chances of partial or complete failure from the effects of such adverse weather conditions as were encountered during the last two springs. And the problem to be solved is how to produce a fair crop of fruit despite these drawbacks and adversities. In my opinion this can only be accomplished by breeding hardiness and by retarding blossoming to as late a date as possible. The law of heredity is as helpful to the horticulturist as to the stock breeder, and the qualities of hardiness and lateness of putting forth blossoms and leaves may be developed by careful breeding. And to a limited extent, at least, judicious location and protection from the too fervent heat of early spring, may serve to delay blossoming till the time of danger is past.

The difference of eight or ten degrees in the daily mean temperature of the southern and northern tiers of counties makes a very marked difference in the development of fruit buds and blossoms, the blossoms appearing from eight to twelve days earlier in the southern districts. But

the occasional blizzardy northers which sweep over the State in April and May are well nigh as severe in the southern as in the northern districts, and the effects are therefore more damaging. That accounts for the fact that in the last two seasons the apple crop scored a higher percentage in the northern than in the southern half of the State. The fruit growers of the north have been compelled to make more careful selections as to hardiness and other qualities of adaptation to their climate, and their trees are more careful of their tender buds in early spring.

Captain Speer tells us that many fruit trees have been killed by the sudden thawing of their roots early in April. This would seem to indicate the necessity of mulching after freezing, or other method of holding the frost in the ground to as late a date as possible. And it would also prove the wisdom of the selection of northern slopes for orchards, especially in the southern districts. With the requisite quality of hardiness and ripeness, our apple trees can withstand any degree of below zero temperature incident to our climate; but even the most hardy will yield to the solicitations of the fervent heat and powerful solar rays of early spring, and put forth bud and blossom before the reign of summer is well established. That is one of the greatest drawbacks encountered by our orchardists, and it cannot be remedied by breeding. It may be mitigated by care in the location of fruit trees, and by artificially retarding too early development.

In my opinion our horticulturists would do well to hedge against this difficulty. In other words they should plant evergreen hedges and dense timber belts, whenever it is practicable, at the highest point south or southwest of their orchards and fruit gardens. This should be done for the double purpose of retarding premature development in spring and tempering the hot, scorching winds of summer. This will not remedy the whole trouble but it will do much by way of mitigation. If a man has but a limited acreage to devote to fruit he will do well and obtain better returns if he will plant one-tenth (or better, one-fifth) of his ground in dense timber for shelter.

In this region we have a large percentage of sunshine, and this subjects fruit trees to the serious effect known as sun scald. The most serious damage is caused generally in early spring, before the foliage has started. In April it is not uncommon to have a number of very bright days, with a maximum temperature ranging along in the eighties. There is tremendous force in the direct solar rays at that season of the year and trees that have successfully weathered the blizzards and extreme cold of winter may succumb to the powerful effect of untempered sunshine. It would seem that by the exercise of care and ingenuity this trouble may be wholly avoided. It certainly is worth while to discuss the question and to devise means to that end.

In the southern central districts of the State, and to a limited extent in the northern districts, we have occasional blasts of hot winds—fiery blizzards from the southwestern plains—the temperature ranging near the top of the nineties, and the wind blowing at a velocity of twenty-five to thirty miles an hour. These winds are often exceedingly dry as well as hot, the percentage of humidity ranging from 35 to 40. The following figures from the records of the central station will serve as samples:

Date—1890.	Max. Temp.	Wind Velocity.	Direction.	Humid. per cent.
July 6	101	27 m	sw	35
July 7	101	25 m	sw	36
July 13	101	18 m	sw	37
July 28	91	28 m	sw	44
July 29	93	30 m	sw	44
July 30	96	38 m	sw	35

During July and August, 1890, there were ten days of similar weather. Three consecutive days of that sort of hot blasts will pretty nearly cook your gooseberries and other garden sauce. Our fruit growers, as well as corn growers, know something of the effects of these occasional visitations of simoons from the Great American Desert. It should be stated here that they are not indigenous in Iowa, but are somewhat rare exotics, imported from the southwest. About two years in five we are liable to have these scorchers, of more or less severity.

When they come in full force and fervency, early in the season, small fruits are seriously injured, and the orchard fruits are considerably damaged.

The best we can do is to mitigate their severity by conserving moisture, so far as possible, by means of mulch and wind-break. A dense grove at the southwest, located on high ground, will afford a very large measure of protection to the fruit garden and orchard. And in time of extreme drouth the great value of tile drainage will be attested. In fact, it can be demonstrated that tiles, properly placed, are as valuable in a dry season as in a wet one.

In Iowa we have, on the average, 140 days between the killing frosts of spring and autumn. This gives ample time, other conditions being favorable, for the growth and complete ripening of our vast corn crop, and for the trees and vines adapted to this region. But it sometimes happens that growth is checked in spring or early summer, and then by warmth and moisture late in August a new growth is started and continued till the season of frosts. Under such conditions winter-killing of the immature shoots and buds is an inevitable result. There is no way to remedy this, except by breeding varieties that have an established habit of early ripening. And this habit may be fostered by due care.

In Iowa the bulk of our rainfall comes in the spring and summer months when most needed. Our autumns are proverbially mild and dry, and in winter we have bare ground most of the time from December to March. We cannot count on much protection for vines and trees afforded by heavy snows, so the necessary protection must be afforded by other means.

The heavy rain storms which sometimes occur in the season of blossoms when accompanied by hard gales and followed by chilly weather, seriously interfere with pollination and greatly lessen the fruit crop. Probably the shortage in the fruit crop of '92 and '93 was largely the result of imperfect pollination, from the effects of the excessive dampness, heavy downpours and strong gales. Fortunately such seasons are exceptional in Iowa.

In closing this somewhat lengthy paper, it is a pleasure to say that, despite all the drawbacks enumerated, Iowa horticulture is steadily progressing, and for this great credit is due to the brainy and plucky members of our State and district horticultural societies.

In my opinion forestry is the chief hand-maiden of both horticulture and agriculture. If we had begun early and planted wisely, covering one-fifth or even one-fourth of our area with nut-bearing or other useful timber, we should now be able to raise much greater crops of corn and fruit on a much lessened acreage. We have now less than 200,000 acres of artificial groves, and about 2,000,000 acres in natural groves. The natural groves serve a good purpose and should be carefully preserved; but these are so located that they afford small protection to the vast regions of upland prairie. We should have at least 5,000,000 acres in planted timber, and our State will never attain its best in fruit and staple crops until we provide these great conservators of moisture and barriers against severe wind storms.

With great timber belts, judiciously located, and by the construction of artificial ponds and lakes, we may in time be well nigh exempt from damage by hot winds and drouths, and we may even ward off a large measure of danger from tornadoes.

We are compelled to dig or bore deeper wells to strike our constantly receding water level. Our annual rainfall holds up to the average of fifty years, but the water level is constantly being lowered. We must be less prodigal of our moisture, retaining as much of it as possible by artificial forests and ponds. By this means we may make Iowa literally the garden of America, and not merely an immense corn field.

SOMETHING OF IOWA'S CLAY RESOURCES.

BY E. H. LONSDALE, IOWA GEOLOGICAL SURVEY.

The clay deposits of Iowa have never been fully appreciated, either by the citizens of the State nor those residing outside. Yet, manufactured clay products form one of the most important factors in the industrial welfare of the commonwealth. The value of building materials, pottery and other products made from clay, which are used every year in the State, cannot be far from $20,000,000.00. For many years Iowa has sent out large sums of money for the purchase of her materials. Exact figures at this time cannot easily be obtained, but the proportion of the annual expenditure for clay products used, which is sent out of the State, is very large, fully half of this total. There must be explanations for this. At first glance it might appear as if the State did not contain material suitable for the manufacture of clay articles, and this is probably the general impression, both at home and abroad. But this is hardly true, for there are not only suitable beds of clay in this State, but innumerable and exhaustless deposits, many of which are of very superior quality, and scarcely any which have not properties adapted for the manufacture of a good quality of all the ordinary structural materials. This statement may seem broad, nevertheless, it is not an exaggeration. In all sections of the State, regardless of geological formation there lie beds of clay of just such a character as those just mentioned. With few or no exceptions, every county has enough good clay not only to supply the local market but the entire State.

There are in Iowa more than twenty distinct geological formations beneath the soil and drift. Of these every one may be said to bear clays of economic value. In more than half of the number can be found fine clays in limitless quantities. The clays of the formations under the drift mantle occur as shales originally deposited between beds of hard rock. Some of these shale beds have attained great thickness, frequently as much as one hundred feet and sometimes more without any perceptible alteration in lithological structure, or at least not enough to prevent the successful working up of the whole section. Different factories in the State have at their command clay banks approximating this great thickness; such heavy banks are not confined to any one locality, but they exist in all of the four quarters of the State, represented in the upper Cretaceous in the northwest, the Devonian and Silurian in the northeast, and the Carboniferous in the central and southern parts of the State. From the clay shales of these several formations can be made almost every kind of common structural and ornamental clay products. These would include all varieties of brick, from the hand-made to the dry-press and the paver, all forms of ordinary and fancy pottery, drain tile, sewer pipe, and such other forms as are ordinarily made from any clay. As has been said, perhaps without exception, each county in the State has clay enough to supply all its wants for centuries to come. In some cases, however, the clays of the older, bedded formations are inaccessible on account of the heavy drift deposit which rests thereon, completely concealing the shale clays. Then, these more recent deposits must therefore be relied upon to furnish material sufficient to supply, at least, the local demands. From these drift clays, the loess, prairie loam and alluvial soil are manufactured excellent brick and tile, the drift alone appearing in such thickness and character that it is commonly quite practicable to erect a clay plant thereon. By this is not meant that any of the clay of the drift is, as it comes from the bank, ready to be transformed into a moulded article which will, when burnt, be a first-class article. On top of the heavier drift clays may be usually found a soily material which will serve as a brick clay, but to secure an extensive bed, one that will answer for both brick and tile, prospecting must necessarily be done; the character of the drift is so variable in different localities that, commonly, after but little searching, such a workable clay is found. It may be that only the yellowish calcareo-siliceous drift clay will be met. In that case washing the clay must needs be resorted to in order to rid it from the hollow concretions of "lime" which are often, if not always, so abundant throughout this clay. Besides this clay there are in Iowa two other typical clays of the Ice Age which may be made into brick and tile. The one is a yellowish gray loess-like clay with brown streaks and spots, colored by oxide of iron. The other is the well-known "blue" clay, a grayish blue massive, finely silicious

clay; the texture is uniform or nearly so throughout; it is quite plastic when moistened and after moulded must be dried very carefully to avoid checking (cracking). When burnt the articles are of a rather pale red color. The other drift clays produce, when burnt, a darker red color. The soil, alluvium and loam, the materials from which the first bricks were made in this State, are yet used and good home-made bricks secured.

Along the Missouri and the Sioux on the west, the Mississippi on the east and in the interior along the Des Moines and elsewhere, are a large number of counties which are dependent almost solely on the loess (formerly known as the "bluff" deposit.) From this formation are made bricks excelled as a front brick, in beauty and durability, by none. 'Tis true that only recently the attempts to make dry-press finish brick from this loess have been successful, although for years it has been used in the stiff-and wet-mud machines. Considering the small amount of experimenting which has been done along this line the product now made is admirable and goes to show that it is only a question of a short time until the brick-makers of Iowa will produce a super-excellent front brick, using the loess.

Methods adopted in preparing, moulding and burning the clay will not here be considered in detail, Nearly three hundred and fifty years ago the first burnt brick were made in what is now the United States, but not until the early part of the eighteenth century did brick-making become at all common in this country, and more than a century then elapsed before marked improvements in the modes or machines for manufacturing common brick were made. About thirty years ago the first brick machine was introduced into Iowa and ever since that time the progress of the industry has been great, but more especially so within the last ten years. To-day the work is here largely done by machine, while prior to thirty years ago it was done entirely by hand. In recent years stiff-mud and dry-press machines have taken the place of the wet-mud machines, for a long time the only kind made.

The problem, of making a good paver, has been solved. Only a few years ago was it proven possible to produce a vitrified brick without at the same time alter ing its regular shape. Success here; the brick as a popular paver, stood foremost. Now in nearly all the largest cities in the State are one or more plants which make an excellent paver. Paving streets with hard bricks is fast becoming so popular, as well it may, that all over the State the principal streets of the larger towns and cities are being paved with them. Tests are continually being made which go to prove that the durability of a street paved with vitrified brick compares most favorably with that of streets paved with any other materials. In almost every case does the brick-paved street prove to be more durable. As a consequence, in the place of blocks of wood, granite and other hard rock which have been used for years, will be substituted vitrified brick, wherever such can easily be obtained.

In very recent years the value of draining fields has been recognized; this, together with the advantages gained when tile instead of an open ditch is used for this purpose has brought the tile into general service. From year to year the output for the preceding year has been multiplied. Again, in preference to the two-inch tile originally used, larger sizes are desired until now the small tile is seldom made at any of the large number of factories. Notwithstanding the great advancements made in the clay industry since its birth, there is yet much to be done in this direction. A great many factories employ defective methods; work is prosecuted in a haphazard sort of a way. When a good quality of clay is at hand it is certainly advisable and important that the best results be obtained with the least expense possible. These defective methods, ofttimes seemingly unimportant in themselves, cause in the end a waste of much extra time, expense and material. In the first place the work should be so systematized that useless labor will be avoided and the whole labor done with the greatest ease. From the time the clay leaves the bank until the burnt products are stacked on the yard, evidences of an imperfect arrangement, or system, are visible. It is just as easy and inexpensive to have a perfect arrangement as one which takes from the profits, often extensively; it is just as convenient to have a machine that will treat the clay properly as one that will simply mould the article without regard to its quality. The better the article the greater the price; on the other hand the poorer the article the less the price. The machine which will handle the clay to the best advantage, can be seen by an examination of the clay at hand. Be assured, first, that the clay will make a good article, then look into the means by which the clay can be treated to produce the best results. It is not uncommon for an amateur in the clay business to go it blind," without any regard to the result.

Instead of Iowa going abroad for nearly half the total amount of clay products used in the State, she should be supplying the states around her and, indeed, the whole northwest with products of her own manufacture. This she might so well do.

It must be confessed that there is a dearth of literature which treats, even in a general way, of the clays of our State. There is information needed which will elevate' broaden, and otherwise improve the industry in general. Nothing is known concerning the properties, distribution and extent of Iowa clays. Under the direction of the Iowa Geological Survey a work of this character has been begun; the distribution of the clays are to be definitely defined; the composition and properties of typical samples carefully determined. In this report it is not only proposed to furnish the chemical, but also the physical properties; by the aid of which latter can be more thoroughly appreciated, and by which the exact character of the clay can more readily be seen. The plan of the work will be something after the order of the following, taking for example a sample from a heavy bed of fire-clay:

A preliminary examination shows—

Color varies from light gray or "blue" to drab.

Texture is nearly uniform; fine grained compact, quite hard.

Taste, " lean," gritty.

Slacks slowly into granules non-uniform in shape and size.

Accessories. Pyrite not perceptible. Sand, as grains from one-tenth to one-thirtieth of an inch in size, freely disseminated.

Physical examination shows:

Specific gravity (not yet determined).

Plasticity, as determined by working the clay paste is eminent; as determined by the tensile strength of air-dried briquettes it has a maximum of 168, and the average of eight samples was 150 pounds per square inch.

Water required to make a plastic, easily worked paste is 17.2 per cent.

Air shrinkage, in drying bricklets ranging from 4 inches by ¼ inch to 10 inches by 4 inches by 4 inches, averaged 5.8 per cent in twelve samples. It can be dried rapidly in a warm air bath at 125° to 200° F. without breaking.

Fire shrinkage, in burning air dried samples at a vitrifying heat averaged 2.3 per cent in three samples; requires care and slow heating to avoid cracking samples.

Total shrinkage, or the sum of the air and fire contraction averages 8.1 per cent, or is remarkably low.

Fusion takes place at about 2,400° F., or white heat; incipient vitrification takes place at 2,100° F., or at a bright, cherry red heat.

Color of burnt clay is light gray.

Conclusion: This fire-clay is a fairly good refractory clay, as it can be used for temperatures as high as 2,300° F., or a very bright cherry heat. It admits of rapid air-drying without cracking and does not crack readily in firing. The total shrinkage being very low adds greatly to its value in any practicable application of the clay. Being highly plastic it moulds admirably. The burnt ware is quite strong. The clay can be washed and used by potters successfully, and it is even possible that a white ware may be produced if the clay is properly washed.

As an industry, clay presents one of the most important. However small this industry be, providing a substantial article is produced, it is an industry which any community should encourage. This is impressively so in a locality or county which is not supplied with native building stone in sufficient quantity and quality to supply all demands for structural purposes. This condition of affairs exists in perhaps one-half of the total number of counties in Iowa. Not depreciating the immense value of good building stone in any locality, it is well understood that there are varied purposes for which brick are used that can not conveniently be answered by stone. Hence, the demand for brick is universal in settled territories.

It is not uncommon for manufacturers to ship their clay products to such a distance that the freight on any number of brick amounts to as much, or more than the original cost of the same number at the factory. Even within our own State there are localities which do now pay this additional price for a first-class article. Of course, more conveniently situated sections are more fortunate in this regard, showing that from an economic standpoint much is to be gained by having the industry and having it at home.

Over Iowa are distributed nearly five hundred clay industries. At many of this number are made only a single kind of product; at more extensive concerns attention is given to the manufacture of several kinds. Though this number may seem large it must be remembered that they supply only half the demand. The list of industries include all from the hand-yard in which is burnt perhaps but one small kiln each summer to the plants or factories which operate year in and year out making twenty to thirty or fifty thousand brick daily. To provide for the ever increasing demand for clay products either the factories now manufacturing these products must nearly double their annual output or the number of clay industries must be greatly increased.

MISSION OF THE FROST.

In a sermon delivered Sunday, December 3d, the Rev Dr. Talmage discoursed upon the timely subject, "The Mission of the Frost." We copy the following eloquent paragraphs:

This is the first Sabbath of winter. The leaves are down. The warmth has gone out of the air. The birds have made their winged march southward. The landscape has been scarred by the autumnal equinox. The huskers have rifled the corn shocks. The night sky has shown the usual meteoric restiveness of November. Three seasons of the year are past and the fourth, and last, has entered. Another element now comes in to bless and adorn and instruct the world. It is the frost. The palaces of this king are far up in the Arctic. Their walls are glittering congelation. Windsor castles and Tuilleries and Winter palaces and Kenilworths and Alhambras of ice. Temples with penchant chandeliers of ice. Thrones of iceberg, on which eternal silence reigns. Theaters on whose stage eternal cold dramatizes eternal winter. Pillars of ice. Arches of ice. Crowns of ice. Chariots of ice. Sepulchers of ice. Mountains of ice. Dominions of ice. Eternal frigidity! From those hard, white, burnished portals King Frost descends, and waves his silvery scepter over our temperate zone. You will soon hear his heel on the skating pond. You already feel his breath in the night wind. By most considered an enemy coming here to benumb and hinder and slay, I shall show you that the frost is a friend, with benediction divinely pronounced, and charged and surcharged with lessons potent, beneficent and tremendous. The Bible seven times alludes to the frost, and we must not ignore it. " By the breath of God frost is given."

First, I notice Frost as a painter. He begins his work on the leaves, and continues it on the window-panes. With palette covered with all manner of colors in his left hand, and pencil of crystal in his right, he sits down before the humblest bush in the latter part of September, and begins the sketching of the leaves. Now he puts upon the foliage a faint pallor, and then a touch of brown, and then a hue of orange, and then a flame of fire. The

beech and ash and oak are turned first into sunrise and then into sunsets of vividness and splendor. All the leaves are penciled one by one, but sometimes a whole forest in the course of a few days shows great velocity of work. Weenix, the Dutch painter, could make in a summer day three portraits of life size, but the Frost in ten days can paint ten mountains life size. It makes the last days of an autumnal wood the day of its chiefest glory. Luxembourgs in the Adirondacks, Louvres in the Sierra Nevadas, Vaticans in the White mountains. The work of other painters you must see in the right light to fully appreciate, but the paintings of Frost in all lights are enchanting, and from the time when the curtain of the morning lifts to the time when the curtain of night drops.

When Titian first gazed upon a sketch of Correggio he was wrought up into such an ecstasy that he cried out: "If I were not Titian I would be Correggio," and so great and overpowering are the autumnal scenes of our American forests that one force of nature might well exclaim to another: "If I were not the sunlight I would be the frost."

Next I speak of the frost as a physician. Standing at the gates of New York harbor autumn before last the frost drove back the cholera, saying: "Thus far shalt thou come and no farther." From Memphis and New Orleans and Jacksonville he smote the fever plague till it reeled back and departed. The frost is a physician that doctors cities, nations and continents. He medicines the world. Quinine for malaria, antifebrile for typhoids, sulphonal for sleeplessness, antispasmodic for disturbed nerves, but in all therapeutics there is no remedy like the small pellets prepared by the cold, and no physician so skillful or so mighty as the frost. Scotland has had great physicians, but her greatest doctors have been the Abernethies and Abercrombies that have come down over the highlands horsed on the north wind. England has had her great physicians, but her greatest doctors have been the Andrew Clarkes and the Mackenzies who appeared the first night the fields of England were rimmed with white. America has had her great physicians, but her greatest doctors have been the Willard Parkers and Valentine Motts who landed from bleak skies while our ears tingled with the cold. Oh, it is high time that you add another line to your liturgy. It is high time that you make an addendum to your prayers. It is high time that you enlarge the catalogue of your blessings. Thank God for frost! It is the best of all germicides. It is the only hope in bacteriology. It is the medicament of continents. It is the salvation of our temperate zone. It is the best tonic that God ever gave the human race. It is the only strong stimulant that has no reaction. The best commentary on it I had while walking near here one cool morning with my brother John, who spent the most of his life as a missionary in China, and in that part of it where there are no frosts. He said there was a tingling gladness in his nerves indescribable, and an almost intoxication of delight from the fact that it was the first time for years he had felt the sensation of frost. We complain of it, we scold it, we frown upon it, when we ought to be stirred by it to gratitude and hoist it on a doxology.

DRAINAGE AND DROUTHS.

Since the advent of tile draining in Illinois, and to some extent in Iowa and other States, the opinion has been frequently expressed by writers in the districts that have been more or less affected by drouths, that they are caused by the prevalence of the practice of drainage in these districts. It is maintained that drainage, by drying up the ponds and drawing off the surface water, decreases the evaporation and in this way decreases the rainfall. It is not surprising that writers, and especially farmers in these districts, should come to this conclusion. We do not believe, however, that it will be held by men who have given the subject comprehensive study. We are beginning to realize more and more that the arrangements of the Creator for watering the earth cover a very broad field, and are not very liable to be seriously interfered with by the simple operations of which man is capable, unless these are prolonged over a very large area of country and for a very long period of time. It will be readily conceded that man, by cutting off the forests in the mountains, and hence destroying the leaf-mold which holds the water and prevents its sudden flow into streams, may decrease the volume of the rivers in summer and greatly increase their flow in the winter. This is an interference with the flow of rain after it has fallen, but there is no conclusive evidence that the average volume of rainfall over a long period of years has been affected by the destruction of timber. Drainage interferes with the disposition of water after it has fallen, but we see no reason whatever for concluding that drainage or want of drainage has in the least affected the number of inches of rainfall. We noticed particularly during the protracted drouth in Iowa some years ago that it was more severe in the northern portion of the State, where lakes and ponds, at that time undrained, and still so to a large extent, are quite abundant, and in the timber portions of the State, than it was in the treeless, pondless, sloughless west third of the State. We do not mean by this that trees and ponds are productive of drouth, for we do not believe they are, but we cite the fact simply to show that conclusions as to the effect, either of tree planting or draining, on the amount of rainfall, must be based, if correct, on a much broader collection of facts than anything which is available at present. We advise farmers, therefore, who have lands too wet for cultivation, whether they be swales or sloughs or bottoms, to go ahead with their tiling. The object of tile draining is to remove water which at present does them an injury. They will find that tile-drained land will endure dry weather better than land from which the water has been allowed to go off by evaporation. We recall an incident of forty years ago or more, of a farmer's wife who said to her husband, who was draining a tract of very wet land, that he would want to stop up his drains during the summer time. "My dear,' he said, "when that time comes there will be no water to drain under any circumstances, and the land will be covered with cracks, the result of the drouth, into which you could put your hand, if I did not drain, mellow as an ashheap and moist if I do." The result of a drain placed ev-

ery thirty-three feet over the entire tract fully justified his prediction. No man can prevent drouths in a country subject to drouths, either by draining, tree planting, or the lack of either. He can, however, by draining his land and having the water under complete control, modify the effect of both floods and drouths, and this is the true philosophy of tile draining.—*The Homestead.*

NOVEMBER WEATHER REPORT.

The mean temperature of the month, 34°, was about the normal for the State. The first half of the month was above, and the last half below the normal.

The average precipitation as shown by records of seventy-three stations, was 1.17 inches, which is about .50 of an inch below the normal amount. The first and second decades were unseasonably dry, the bulk of the precipitation falling in the last decade. The first general snowstorm occurred on the 30th. The ground was unusually dry at the close of the month, and the water supply is very scant in the larger part of the State.

The following table gives, as a basis of comparison, the mean temperature and total precipitation at the stations, named, for the years from 1872 to 1893, inclusive:

YEARS.	MEAN TEMPERATURE, DEGREES.						PRECIPITATION, INCHES.					
	Des Moines.	Davenport.	Dubuque.	Keokuk.	Omaha.	Sioux City.	Des Moines.	Davenport.	Dubuque.	Keokuk.	Omaha.	Sioux City.
1872	....	32	...	33	30	....	.....	1.86	.....	0.74	0.87	....
1873	....	34	31	37	38	..	...	0.63	0.77	1.43	0.19	.....
1874	....	36	34	40	36	....	.....	2.47	4.17	2.17	1.05	.....
1875	....	33	34	36	33	....	.....	0.57	0.48	0.59	0.13	.. .
1876	....	35	34	37	33	....	.....	2.54	2.49	2.82	1.17	.....
1877	...	37	35	40	36	....	.....	2.53	3.31	3.05	1.36	.....
1878	42	42	40	43	44	..	0.34	0.90	0.76	1.93	0.27	.....
1879	39	40	37	42	40	....	6.49	4.70	5.41	3.91	4.25	.....
1880	28	31	28	31	36	....	1.97	1.23	2.11	1.13	0.70	.....
1881	36	40	36	40	37	....	3.97	2.19	3.19	2.59	1.29	.....
1882	39	42	38	42	40	....	2.81	1.47	1.55	2.25	2.05	....
1883	39	42	38	43	39	....	1.32	3.58	1.65	2.09	0.64	. ...
1884	38	40	36	41	39	....	1.26	1.49	1.43	1.73	0.32	. ..
1885	39	38	38	42	40	....	0.61	1.20	0.64	0.88	0.73	....
1886	36	35	33	39	34	....	1.86	0.74	1.89	1.15	1.54	.....
1887	37	37	35	42	40	....	0.52	1.13	0.74	1.18	0.89	.....
1888	36	38	37	42	37	....	2.09	3.54	2.75	2.83	0.12	. ...
1889	34	37	35	38	36	33	1.29	2.17	1.57	1.80	0.87	1.99
1890	41	42	40	44	42	40	0.74	1.37	1.85	1.87	1.01	0.84
1891	32	32	31	36	34	30	1.34	3.56	3.24	3.60	0.37	0.37
1892	35	33	31	36	38	35	0.76	2.01	1.89	3.16	0.14	0.16
1893	36	36	35	39	37	34	1.51	2.56	2.03	2.29	0.43	0.75
Means	37	39	35	41	37	34	1.80	1.98	2.08	1.96	1.07	0.82

SUMMARY OF WEATHER CONDITIONS.

BAROMETER—Mean pressure for the month, 30.08 inches; highest observed, 30.55 inches at Clarinda, on the 30th; lowest observed, 29.38 inches at Cedar Rapids, on the 21st. Range for the State, 1.17 inches.

TEMPERATURE—Monthly mean as determined from sixty-five voluntary observer's reports, 34°; highest monthly mean observed, 40° at Glenwood; lowest monthly mean, 27° at Osage. The highest temperature reported was 86° at Glenwood, on the 6th; the lowest temperature reported was 13° below zero at Decorah and Spirit Lake, on the 30th. Average daily maximum 45.8°; average daily minimum, 23°; average monthly maximum, 72.3°; average monthly minimum, 3° below zero Greatest monthly local range, 92° at Decorah; least monthly local range, 60° at Ft. Madison. Range for the State, 99°.

PRECIPITATION—Average for the State as determined from seventy-three voluntary observer's reports, 1.17 inches. The greatest amount reported was 2.56 inches at Davenport; the least amount reported was .05 inch at Villisca. Average number of rainy days 4.5; cloudy days, 8; clear days, 16.

SOLAR HALOS—Amana, 3d, 11th and 13th; Hopeville 18th and 22d.

LUNAR HALOS—Greenfield, 22d; Hopeville, 22d.

SLEET—Galva, 27th; Independence, 12th; Larrabee, 24th, 28th; Maxon, 26th; Ovid, 20th, 26th, 30th; Tipton, 26th; Webster City, 29th; Williams, 21st, 25th, 28th; Alta on the 28th.

AURORA—Spirit Lake, 8th; Webster City, 17th, 19th, 23d.

THUNDERSTORMS—Local storms occurred at several points in the State on the 1st and 2d.

ATMOSPHERIC PRESSURE.

STATIONS.	Mean reduced barometer.	EXTREMES.			
		Highest barometer	Date.	Lowest barometer	Date.
Cresco	.....	30.53	24	29.44	21
Clarinda	30.11	30.55	30	29.45	21
Cedar Rapids	30.08	30.45	24	29.38	21
Davenport	30.07	30.47	25	29.42	21
Des Moines	30.09	30.49	24	29.41	21
Dubuque	30.05	30.46	25	29.42	21
Keokuk	30.08	30.48	24	29.41	21
Omaha (Neb)	30.11	30.54	30	29.47	21
Sioux City	30.07	30.52	30	29.40	21
Means	30.08	30.55	30	29.38	21

WIND MOVEMENT.

STATIONS.	Miles.	Maximum velocity.	Direction.	Date.
Davenport	6,867	37	SW	22
Des Moines	5,565	34	SW	16
Dubuque	4,085	24	NW	21
Keokuk	5,572	32	W	21
La Crosse (Wis)	5,935	27	NW	22
Omaha (Neb)	5,704	30	NW	30
Sioux City	8,023	42	S	25

OBSERVER'S NOTES.

Belle Plaine—W. W. VANDIKE: Owing to the prolonged drought water will be scarce for stock outside of the artesion belt.

College Sprinys—A. A. BERRY: A splendid month for gathering corn. A good turn out, and plenty of rough feed. Month closed stormy and wintry.

Clinton—DR. LUKE ROBERTS: November was a fine month. The mean temperature was 6.4° above normal; minimum 3.8° below; mean 1.2° below normal.

The warmest day was the 1st; the mean temperature being 61°; coldest day the 29th, the mean temperature being 27.2°. There were 8 stormy days, 3 cloudy and

15 clear. Per cent of cloudiness 32. Prevailing direction of wind, west; maximum velocity 26 miles an hour; total movement 4,260 miles—22 below normal.

BELATED REPORTS,

COUNCIL BLUFFS, August: Mean temperature, 71.6°; maximum temperature, 96°; minimum, 43°. Total rainfall, 3.84 inches; number of days on which .01 inch rain fell —.

COUNCIL BLUFFS, September: Mean temperature 64.2°; mean maximum temperature, 78.2°; mean minimum temperature, 50.2°; highest temperature observed, 94° on the 10th; lowest observed, 32° on the 25th. Rain fell on two days.

COUNCIL BLUFFS, October: Mean temperature, 54.5°; mean maximum, 68.2°; mean minimum, 40.8°; highest temperature observed 86° on the 8th; lowest observed, 23° on the 15th; .01 inch rain fell on the 1st.

MARSHALLTOWN, October: Mean temperature, 53.6°; mean maximum temperature, 65.7°; mean minimum, 41.4°; highest, 85° on the 1st; lowest, 16° on the 29th. Total rain fall, .62 inch; number of clear days, 23; part cloudy, 8; cloudy, none. Prevailing wind, north; number of days on which .01 inch rain fell, 2.

CLINTON, September: Mean temperature, 52.7°; mean maximum temperature, 65.6°; mean minimum, 39.8°; highest temperature observed, 82° on the 11th; lowest temperature observed, 18° on the 30th; range for the month, 64°. Total rainfall, .68 inch; number of clear days, 15; part cloudy days, 13; cloudy days, 3; number of days on which .01 or more inches rain fell, 4. Killing frost on the 15th.

AMES (sw of): Mean temperature for October, 54.6°; maximum, 88° on the 8th; minimum, 20° on the 29th. Total rainfall, .52 inch. Thunderstorm on the 5th; Solar Halo on the 21st: Lunar Halo on the 21st.

NEWTON, October: Mean temperature, 53.2°; highest observed, 87° on the 1st; lowest, 18° on the 29th. Total rainfall, 1.17 inches; clear days, 18; part cloudy, 4; cloudy, 6; rainy, 6. Thunderstorm on October 1st.

METEOROLOGICAL DATA FOR NOVEMBER, 1893.

STATIONS.	TEMPERATURE OF THE AIR (IN DEGREES FAHRENHEIT).								PRECIPITATION IN INCHES.			Prevailing direction of wind.	Killing frost.	No. of cloudless days.	No. of partly cloudy days.	No. of cloudy days.	No. of rainy days. (.01 inch or more).	No. of hail-storms.	No. of thunder-storms.
	Monthly mean.	EXTREMES. Mean maximum.	Mean minimum.	Maximum.	Date.	Minimum.	Date.	Monthly range.	Monthly.	Total snowfall.	Depth of unmelted snow at end of month.								
Algona	*31.9	.....	.....	†72	1	-10	30	82	.60	4.5	3.5	NW	....	11	10	9	4	..	..
*Alta	31.0	41.6	20.5	74	1	- 9	30	83	.96	6.2	2.0	NW	....	15	8	7	6	..	..
Ames (Jos. J. Edgerton)	32.4	44.5	20.3	72	6	- 3	24	75	.65	....	....	NW	....	....	....	....	5	..	..
Ames (W. H. Heilman)	....	....	....	....	....	....	....	....	.43	3.0	3.0	NW	....	....	....	....	3	..	..
Ames (4 miles sw of	*36.3	....	....	80	6	- 2	24	82	....	2.3	2.0	....	....	....	....	....	6	..	..
Amana	33.1	43.1	23.2	70	1	- 1	30	71	1.73	4.0	4.0	NW	....	19	7	4	5	..	1
Atlantic	34.8	48.4	24.2	78	5	- 3	30	81	.77	2.3	2 0	NW	....	17	3	10	3	..	..
Audubon	33.3	45.3	21.2	70	1	- 4	30	74	1.00	8 0	6.0	NW	....	6	14	10	3	..	..
Belle Plaine	32.8	43.8	21 8	71	1	- 5	30	76	1.51	7.5	6.0	S	....	12	11	7	5	..	..
Bonaparte	36.5	48.6	24 4	75	1	4	24	71	1.61	2.5	T	....	....	....	....	....	6	..	..
Carroll	31.6	43.3	19.9	72	1	- 5	30	77	0 77	5.0	3.0	....	....	20	2	8	6	..	..
Cedar Falls	32.3	44.2	20.4	75	1	- 7	29	82	0.55	5.0	....	NW	....	15	3	12	3	..	..
Cedar Rapids	34.3	42.1	26.5	68	1	3	24	65	1.24	5.0	....	S	....	22	3	5	6	..	..
Centerville	37.3	51.6	23.0	75	4	2	30	73	1.45	1 5	1.5	SW	....	25	4	1	2	..	..
Charles City	31.1	41.0	21.2	70	1	-10	24	80	1.09	7.0	5.0	S	....	....	....	....	4	..	..
Clarinda	35.2	46 2	24.2	70	1	- 2	30	72	1.05	3.0	T	NW	....	19	5	6	4	..	..
Clinton	34.3	45.4	23.3	73	1	1	24	72	1.77	7.0	4 0	W	....	9	14	7	8	..	..
College Springs	36.6	48.7	24.4	72	5	6	24	66	0.79	1.5	0.5	N	....	13	12	5	4	..	..
Corning	37.4	50.0	24.8	72	1	2	30	70	1.10	0.2	.....	SW	....	17	8	5	3	..	..
Cresco	29.5	40.4	19.0	72	1	-12	24	84	0.84	6.0	4.5	NW	....	12	12	6	4	..	..
Davenport	36.0	44.5	27.9	71	1	4	24	67	2.56	....	.....	SW	....	11	11	8	7	..	2
Decorah	31.4	42.8	20.0	79	6	-13	30	92	1.51	4.5	4.0	....	....	18	6	6	3	..	..
Delaware	29.6	.....	.....	†65	1	- 8	30	73	1.81	5.5	.....	NW	....	15	5	10	7	..	..
Des Moines	35.8	44.6	26.0	72	1	1	30	71	1.51	8.1	8.0	NW	....	15	11	4	4	..	..
Des Moines (5½ miles southeast of)	35.6	47.3	23.8	73	1	0	24	73	1.22	4.0	4.0	NW	....	12	9	9	3	..	..
Dubuque	36.0	42.4	26.1	72	1	- 1	24	73	2.03	....	.... ..	NW	....	12	8	10	8	..	..
Elkader	32.3	44.1	20.6	73	1	- 8	30	81	1.25	6.3	3.0	NW	....	20	7	3	5	..	..
Emmetsburg	30.1	44.6	15.6	76	1	- 8	30	84	.10	1.0	1.0	NW	....	20	0	10	1	..	..
Ft. Madison	38.8	.....	....	68	11	8	25	60	2.20	3.5	3.5	NW	....	9	12	9	5	..	..
Fulton	32.8	....	....	....	....	....	....	....	1.05	10.0	4.0	SW	....	15	8	7	4	..	..
Galva	33.5	45.4	21.5	74	1	- 4	24	78	.79	7.9	2.0	SW	....	12	12	6	4	..	..
Glenwood	40.0	54.6	25.3	86	6	2	30	84	.23	....	.....	S	....	19	6	5	1	..	..
Grand Meadow	32 3	....	....	†67	1	- 8	24	75	1.34	8.2	7.0	S	....	13	11	6	6	..	..
Greenfield	36.0	48.4	23.6	75	1	- 1	24	76	.90	2.3	1.5	NW	....	19	3	8	4	..	..
Grinnell	38.7	45.3	28.7	68	1	0	30	68	1.85	4 8	4.5	S	....	15	10	5	3	..	..
Grundy Center	31.0	43.2	18.7	72	1	- 9	30	81	1.11	3.0	3.0	NW	....	16	8	6	6	..	..
Hampton	30.8	41.3	20.3	73	1	- 9	30	82	1.93	7.8	6.5	SW	....	13	14	3	5	..	..
Hopeville	....	....	....	....	....	....	....	....	0.60	....	....	....	....	....	....	....	6	..	..
Hopkinton	37.4	....	....	....	....	....	....	....	2.10	7.3	.....	NW	....	8	16	6	6	..	..
Humboldt	....	....	....	....	....	....	....	....	0.31	4.0	4.0	....	....	17	9	4	3	..	..
Independence	33.9	46.4	21.5	72	1	-10	30	82	0.63	6.5	.....	NW	....	18	8	4	4	..	..
Indianola	36 7	48.6	26.7	72	6	0	24	72	1.68	0.5	0.5	NW	....	13	7	10	5	..	..
Iowa City	36.6	48.6	24.7	74	1	2	24	72	1 75	7.0	5.0	NW	....	13	11	6	4	..	..
Iowa Falls	31.0	43.8	18.3	72	1	- 7	24	79	1.37	3.5	3.0	NW	....	....	....	....	5	..	..
Jefferson	36.5	50.0	23.0	70	2	- 5	24	75	.56	2.0	.....	NW	....	20	2	8	2	..	..
Knoxville	34.9	44 9	24 9	71	1	2	30	69	.97	2.0	2.0	S& NW	....	11	11	8	4	..	..
Keokuk	39.0	49.0	29.0	74	1	7	24	67	2.29	4.7	1.5	NW	....	18	7	5	6	..	..
Keosauqua	38.2	49.6	26 9	74	1	7	24	67	1.24	2.8	1.8	.....	....	....	....	....	6	..	..
Le Claire	....	....	....	....	....	....	....	....	1.56	....	....	....	....	....	....	....	9	..	..
Larrabee	31.9	44.9	19.0	74	1	- 9	30	83	.95	8.0	0.5	.....	....	15	9	6	5	..	..
Logan	35.0	45.4	24.7	72	6	0	30	72	.53	6.0	4.0	SW	....	19	2	9	3	..	..
Maquoketa	33.0	.....	... .	72	1	0	24	72	1.21	5.0	4.0	.....	....	....	....	....	....	..	..
Mason City	....	43.3	.....	69	3	....	....	....	.63	4.8	.....	....	....	17	0	13	5	..	..
Maxon	33.8	....	....	....	....	....	....	....	1.23	0 5	.....	....	....	9	18	3	5	..	..
Mechanicsville	33 1	42.0	24.2	†30	1	- 1	24	70	1.62	14.0	9.0	S	....	13	8	9	7	..	..
Monticello	31.0	.....	.....	†68	1	- 5	24	73	1.80	10.5	8.0	NW	....	18	9	3	6	..	..
Mt. Vernon	34.2	.....	.....	71	1	- 4	30	75	....	....	.....	....	....	....	....	....	....	..	..
Mt. Ayr	....	....	....	....	....	....	....	....	.63	1.0	.....	NW	....	....	....	....	3	..	..
Newton	34.3	46.1	22.5	71	1	- 5	30	76	1.43	6.5	6.0	NW	....	18	6	6	6	..	..
Omaha	37.0	46.4	26.5	72	6	0	30	72	.43	....	.....	NW	....	16	9	5	5	..	..
Osage	27.3	....	....	....	....	....	....	....	.73	5.5	3.0	....	....	11	10	9	4	..	..
Oskaloosa	35.9	48.2	23.6	73	1	0	30	73	1.24	2.5	2.0	NW	....	19	6	5	4	..	..
Ovid	36.2	48.9	24.7	72	1	1	30	71	1.16	1.0	0.5	NW	....	13	11	6	6	..	..
Panama	35.0	47.0	23.1	72	1	- 4	30	76	.46	2.9	0.9	SW	....	15	5	10	4	..	..
Richland	33.5	....	....	....	....	....	....	....	1.96	4.5	3.0	....	....	11	16	3	5	..	..
Rock Rapids	31.6	45.2	18.0	72	7	- 6	30	78	0.30	3.0	2.0	.....	....	15	9	6	2	..	..
Sibley	30.4	43.4	17.5	74	1	- 9	24	83	17	2.5	... .	SW	....	16	5	9	3	..	..
Sioux City	34.0	44.9	22.9	73	6	- 4	30	77	.75	....	.....	NW	....	13	11	6	5	..	..
Spirit Lake	32.2	45.7	18.8	†77	1	-13	30	90	.28	....	.....	SW	....	23	4	3	2	..	..
Storm Lake	33.8	44.6	22.9	73	1	- 3	24	76	1.03	6.7	4.0	NW	....	15	10	5	6	..	..
Tipton	34 8	44.8	24.8	70	2	0	24	70	2.00	10.0	6.0	W	....	19	2	9	5	..	..
Villisca	38.4	50.1	26.6	70	2	- 3	30	73	.05	0.5	.....	....	....	....	....	....	....	..	..
Vinton	32.7	....	....	....	....	....	....	....	.80	.40	....	SW	....	....	....	....	....	..	..
Webster City	31.0	.....	.....	74	5	- 3	24	77	1.40	1.8	1.8	NW	....	18	6	6	5	..	..
Williams	30.2	.....	....	73	6	- 9	30	82	1.57	5.4	3.0	SW	....	12	14	4	6	..	..
Means	34.0	45.8	23.0	86	6	-13	30	74.1	1.17	4.6	3.4	NW	....	15.5	8.0	6.5	4.5	..	..

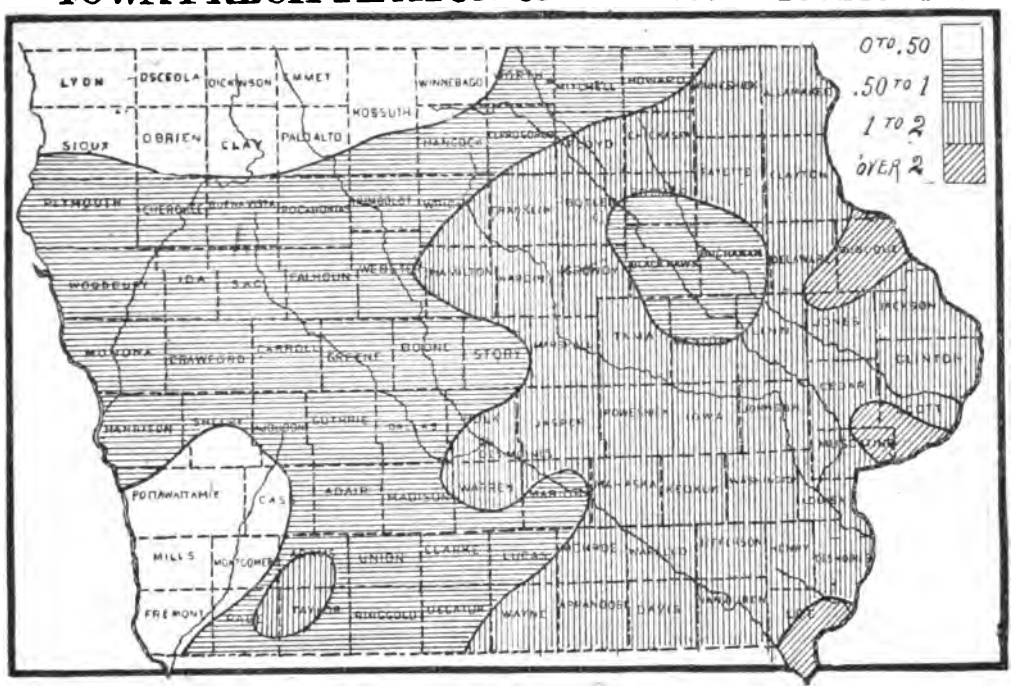
*Extremes taken from eye readings; all others from self-registering instruments. †Not included in means.

STATIONS.	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th	27th.	28th.	29th.	30th.	Month mea
Algona	58	32	34	45	49	54	50	46	48	52	43	28	27	16	26	39	18	28	25	39	31	16	8	10	26	34	27	22	20	-4	31.9
Alta	57	29	34	41	50	56	56	48	49	51	38	24	28	20	20	43	20	19	26	39	32	17	9	4	22	34	23	30	14	-2	31.0
Ames (W. R. Cooper)	52	36	....	36	42	42	46	46	46	46	44	33	32	26	24	42	24	19	27	36	38	22	13	6	24	32	33	37	23	20	32.4
Ames (4 miles sw of)	62	37	36	45	54	59	54	52	54	56	45	32	34	24	28	46	24	25	30	42	36	32	14	12	28	34	31	30	23	9	36.3
Amana	58	34	31	32	47	49	51	44	45	46	52	32	32	27	24	40	26	22	26	36	37	24	14	10	22	32	33	30	24	11	33.1
Atlantic	56	38	30	38	52	50	56	52	44	54	50	32	32	25	25	44	24	20	31	42	38	22	16	13	31	33	28	31	28	8	34.8
Audubon	52	34	32	38	49	52	48	48	45	48	40	28	30	24	29	43	31	20	30	34	38	23	12	10	28	36	32	32	25	10	33.3
Belle Plaine	56	33	31	34	48	52	52	46	45	51	54	31	32	26	23	36	24	21	26	36	36	22	14	8	23	32	33	30	24	8	32.8
Bonaparte	61	46	30	36	48	54	52	48	47	52	53	31	35	30	25	44	34	25	29	38	40	26	18	14	26	33	33	34	33	20	36.5
Carroll	62	32	38	40	47	49	50	49	47	51	40	32	30	24	19	38	21	20	26	38	33	20	11	6	23	28	28	29	16	3	31.6
Cedar Falls	55	35	34	38	47	54	53	50	46	52	50	35	34	26	22	39	29	16	24	38	35	20	12	7	15	24	29	26	6	17	32.3
Cedar Rapids	58	36	35	35	48	48	52	45	46	48	48	38	32	28	24	40	28	25	28	37	36	24	14	16	24	32	34	30	28	18	34.3
Centerville	64	44	34	52	54	55	52	47	55	50	32	35	30	38	49	35	32	34	36	46	37	32	24	20	20	23	25	24	24	17	37.3
Charles City	50	32	31	38	44	52	54	50	47	50	43	36	28	23	24	38	22	19	25	34	43	18	8	2	22	32	28	22	18	0	31.1
Clarinda	58	30	32	38	50	54	52	48	46	50	41	32	35	29	30	44	33	24	34	39	41	23	14	16	30	28	32	31	28	13	35 2
Clinton	62	44	32	34	44	49	49	44	44	48	52	42	32	28	24	40	36	24	26	34	35	28	15	8	22	30	34	31	28	14	34.3
College Springs	48	31	35	42	52	56	50	51	50	52	44	36	35	27	29	45	24	24	31	45	44	26	18	16	26	38	32	31	32	36	36.6
Corning	58	46	31	39	52	56	54	50	46	52	46	34	34	30	29	46	38	24	34	42	42	28	16	14	30	36	36	32	30	16	37.4
Cresco	53	27	34	36	46	51	48	44	45	50	44	29	28	19	26	40	18	19	22	37	30	12	4	3	18	31	28	26	18	-1	29.5
Davenport	64	38	34	38	50	54	53	48	48	52	54	36	36	30	24	42	35	24	29	39	37	25	14	10	24	32	34	34	29	18	36.0
Decorah	52	28	34	40	45	59	46	46	46	52	46	31	30	26	28	38	28	26	25	43	28	14	2	3	21	32	28	26	16	-2	31.4
Delaware	54	33	28	30	39	44	42	42	36	46	50	32	29	22	22	36	26	17	23	30	34	20	5	3	18	33	32	27	22	10	29.3
Des Moines	58	38	32	39	54	54	52	50	48	52	48	35	34	28	26	46	25	24	21	42	40	25	14	10	28	34	34	32	27	13	35.8
Des Moines (5½ miles se of)	58	46	32	36	50	53	50	50	47	52	49	44	33	32	26	44	38	24	32	38	39	28	10	10	24	30	31	30	25	12	35 6
Dubuque	62	38	35	36	50	52	53	48	47	50	53	34	36	26	24	40	31	23	29	38	35	24	14	6	18	29	34	32	25	12	34.6
Elkader	54	32	34	36	48	48	52	49	48	48	52	32	34	25	24	39	26	21	27	36	34	20	12	6	20	28	32	28	22	4	32.3
Emmetsburg	56	40	31	38	42	50	50	47	46	49	29	29	29	20	12	41	28	20	24	34	32	19	10	3	20	32	29	22	18	4	30.1
Ft. Madison	42	44	37	41	46	61	59	52	49	55	58	37	45	32	30	50	35	29	32	40	28	28	21	21	30	36	37	38	32	23	38.8
Fulton	61	34	30	32	42	48	42	42	42	48	49	33	34	26	26	44	30	22	23	37	36	22	12	10	28	32	30	31	25	10	32.8
Galva	54	42	38	40	49	53	61	45	46	46	41	24	25	22	22	46	30	25	28	40	35	22	15	4	27	35	26	29	24	7	33.5
Glenwood	62	52	41	46	56	63	57	53	48	52	44	38	38	34	34	51	36	27	36	51	45	27	17	17	32	37	32	30	34	15	40.0
Grand Meadow	55	32	37	38	48	46	49	47	50	52	49	32	32	22	27	44	25	22	26	40	32	19	6	4	20	31	32	32	30	18	4	32.3
Greenfield	60	36	34	40	52	56	52	51	51	52	44	30	34	26	24	44	34	26	30	39	40	24	14	12	30	36	33	34	28	15	36.0
Grinnell	60	46	37	37	48	54	52	50	50	52	52	32	34	27	24	42	38	34	26	39	....	....	....	....	....	32	32	30	28	12	38.7
Grundy Center	51	28	36	38	51	52	48	48	49	50	42	30	30	22	23	38	18	21	26	40	28	16	8	6	20	32	26	26	22	3	31.0
Hampton	54	28	34	36	51	52	30	48	49	50	41	30	32	22	22	38	19	20	24	36	32	17	11	4	20	31	28	23	18	2	30.8
Hopkinton	62	37	36	52	54	56	54	40	48	52	56	37	....	36	24	44	33	27	30	43	36	25	13	11	26	34	36	34	27	18	37.4
Independence	55	48	32	36	46	50	43	49	46	50	50	43	34	28	22	38	38	20	26	36	38	28	14	6	18	30	32	26	26	6	33.9
Indianola	....	50	40	52	62	56	50	50	49	51	54	....	34	26	26	52	40	46	25	46	41	30	....	12	28	40	34	33	26	16	36.7
Iowa City	61	47	32	36	47	50	52	44	48	48	54	48	34	30	25	42	40	25	27	36	40	31	18	14	23	30	34	32	30	22	36.6
Iowa Falls	52	36	35	37	49	50	49	48	44	48	40	30	30	23	20	40	30	19	23	32	33	15	9	2	20	....	28	23	24	12	31.0
Jefferson	56	50	32	38	46	47	52	48	45	50	51	38	36	22	37	40	40	32	30	38	45	35	14	8	25	22	35	32	26	16	36.5
Knoxville	60	37	30	38	52	53	52	46	47	52	53	30	33	28	24	42	27	22	28	36	40	26	12	12	25	34	34	32	32	13	34.9
Keokuk	65	42	35	40	50	54	52	50	50	54	56	36	37	32	26	49	36	26	30	40	40	30	18	16	28	33	34	39	41	26	39.0
Keosauqua	62	49	32	38	48	54	52	48	50	51	52	38	37	32	26	46	37	27	31	40	42	31	19	16	28	34	34	34	32	26	38.2
La Crosse (Wis)	56	35	38	40	52	51	55	52	50	49	53	34	34	25	25	40	30	24	32	40	37	23	11	3	11	24	34	31	20	6	34.0
Larrabee	54	32	36	41	49	56	58	46	48	51	40	22	28	18	23	42	26	20	25	40	36	18	10	4	24	32	28	28	18	6	31.9
Logan	58	29	36	44	51	56	57	48	48	53	38	33	32	30	44	21	22	37	22	39	40	22	10	32	36	36	27	16	24	6	35.0
Maquoketa	58	32	29	31	39	46	46	42	40	44	46	36	33	26	28	41	40	26	26	34	36	22	12	11	31	34	34	32	22	20	16	33.3
Maxon	62	33	25	36	51	56	48	42	48	48	49	28	34	26	29	51	24	19	26	40	36	20	8	10	28	32	32	34	24	9	33.8
Mechanicsville	57	38	36	35	46	50	48	40	50	48	51	34	33	26	22	38	26	26	27	36	38	18	12	7	20	30	32	30	29	25	17	33.1
Monticello	56	33	29	32	44	47	45	41	44	46	46	32	32	24	24	43	26	20	21	36	35	18	6	7	23	31	32	30	23	6	31.0
Mt. Vernon	62	34	33	38	52	55	54	46	48	54	52	32	32	24	26	46	25	24	26	38	38	19	9	10	26	32	33	33	30	27	10	34.2
Newton	58	38	32	34	50	50	49	48	46	50	47	33	33	26	24	42	36	22	27	38	38	29	14	8	25	33	33	30	27	10	34.3
Omaha (Neb)	59	34	37	46	54	58	56	52	51	52	38	30	36	26	32	46	24	26	36	43	42	22	16	19	31	36	32	30	24	16	37.0
Osage	46	28	32	38	46	46	40	42	46	40	30	27	19	24	34	20	14	20	30	40	32	14	4	-1	19	32	30	21	19	2	27.3
Oskaloosa	61	44	32	34	42	52	52	46	45	52	54	34	33	28	26	44	37	23	28	40	42	27	15	12	27	34	32	32	30	12	35.9
Ovid	60	36	30	38	52	55	50	49	47	54	55	36	37	28	26	48	34	24	33	40	41	27	16	13	30	32	34	34	32	16	36.8
Panama	55	40	33	42	50	55	54	60	48	50	42	26	31	24	28	42	31	21	30	40	38	23	12	14	29	34	30	30	26	12	35.0
Richland	62	51	30	38	50	50	51	44	47	47	52	28	32	24	26	46	28	21	25	38	35	23	12	14	25	25	31	32	24	12	33.5
Rock Rapids	50	34	30	43	46	50	48	59	45	52	49	41	39	20	30	27	19	19	25	27	24	22	10	9	16	30	32	28	16	9	31.6
Sibley	53	39	34	38	44	51	53	42	44	50	41	24	26	18	20	40	30	17	18	36	34	18	8	2	..	30	27	28	18	....	30.4
Sioux City	54	30	38	44	51	56	58	48	49	50	36	28	36	26	30	46	19	26	31	44	37	20	14	11	29	34	28	28	16	8	34.0
Spirit Lake	56	40	36	41	50	56	54	44	52	51	46	29	31	22	32	32	28	22	21	38	32	15	14	10	21	29	29	22	14	0	32.2
Storm Lake	56	43	37	42	52	53	53	48	48	50	44	32	32	27	22	41	29	21	28	38	40	19	10	4	22	35	29	26	21	12	33.8
Tipton	47	45	32	40	51	53	52	44	50	54	50	30	35	28	24	40	34	24	28	37	36	25	14	12	10	21	31	32	31	26	17	34.8
Villisca	52	56	51	52	56	51	48	56	52	46	48	46	40	28	36	32	42	20	32	37	36	23	14	18	30	35	29	33	26	16	38.3
Vinton	40	31	38	48	59	49	38	47	51	47	31	33	25	28	....	24	22	24	40	33	33	23	12	10	26	32	30	30	30	24	32.7
Washington	63	33	32	36	50	50	52	48	46	50	58	32	36	27	27	41	28	24	26	38	38	25	14	16	28	34	....	....	....	....	36.6
Webster City	49	31	36	42	46	48	49	46	40	48	39	28	32	22	24	42	19	18	26	40	31	20	12	12	30	33	35	28	18	4	31.0
Williams	52	37	33	42	47	51	48	46	47	47	34	26	28	19	24	43	16	19	28	37	31	14	0	3	24	31	28	22	19	-2	30.2

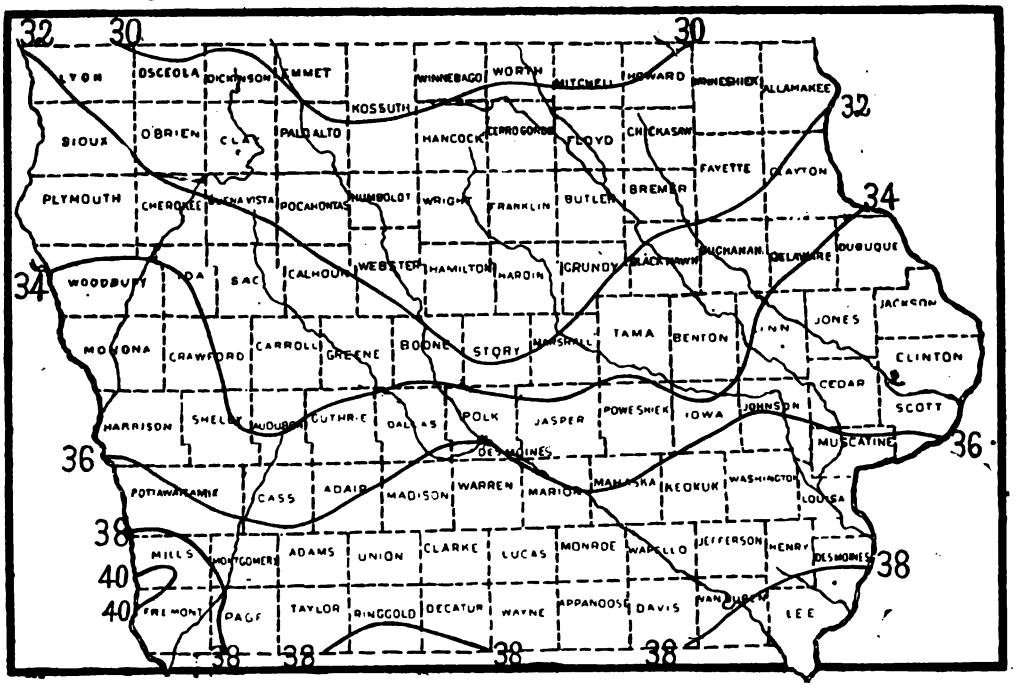
STATIONS.	DATE. 1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	Total.
Algona											0.10										0.15			T		T	T	0.10		0.25	0.60
Atlantic											0.30										0.27			T						0.20	0.77
Alta											0.28		T								0.10			0.04	0.01			0.45		0.08	.98
Ames (Jos. J. Edgerton)											0.18										0.31			0.02		0.10				0.04	0.65
Ames (W. H. Heilman)																					0.31			0.02		0.10					0.43
Amana												0.11									0.52					0.42	0.19			0.49	1.73
Audubon										0.20										0.20										0.60	1.00
Belle Plaine												0.10									0.31			T		0.46	T	0.04	T	0.60	1.51
Bonaparte											0.18	0.10									0.45	0.15				0.64			0.09			1.61
Carroll											0.20									0.04				0.04		0.07		0.12	0.10	0.20	0.77
Cedar Falls												T									0 10						0.05			0 40	0.55
Cedar Rapids		0.11										0.10		T							0.32	0.07			T	T	0.45	0.07	0.02	0.10	1.24
Centerville												T									1.30									0.15	1.45
Charles City												0.19									0.10					0 50				0.30	1.09
Clarinda												0.50									0.40				0.10			0.05			1.05
Clinton	0.03	0.06										0.16									0.45					0.25	0.42	0.06		0.34	1.77
College Springs												0.36									0.42					0.09			0.15		1.02
Corning												0.42								T	0.31				T	0.37		T			1.10
Cresco		T									0.25										0.18					0.22				0.19	0.84
Davenport		0.12										0.13			T						0.55	T			T	0.68	0.78		0.05	0.25	2 56
Decorah																					0.04				0.90	0.06				0.15	1.51
Delaware	0.20										0.08									0.52						0.24	0.02	0.40		0.35	1.81
Des Moines											T	0.18									0.38			T		0.15	T	T	T	0.90	1.51
Des Moines (5½ miles southeast of)											T	0.19										0.42				0.21				0.40	1.22
Dubuque	0.01	0.01										0.05			T						0.30					0.26	0.46		0.46	0.48	2.08
Elkader												0.06									0.33					0.36			0.29	0.23	1.25
Emmetsburg																														0.10	0.10
Fulton		0.03																			0.50					0.20		0.02		0.50	1.25
Ft. Madison												T									0 96					0.75	0.14		0.15	0.20	2.20
Galva											0.10													0.01				0.50		0.18	0.79
Glenwood											0.23																				0.23
Grand Meadow												0.10									0.40					0.36	0.03		0.23	0.22	1.34
Greenfield											0.39		T								0 35			T	T	0.04		T		0.13	0.91
Grinnell											T		T								0.70					0.75	T			0.40	1.85
Grundy Center											0.18										8.30			T	0.16	0.08		0.11		0.28	1.11
Hampton											0.18										0.36			T	T	0.13		0.83		0 43	1.93
Hopeville											T	0.14									0.31			T		0.10	0.02		0.02	0.01	0.60
Hopkinton	0.25												0.15								0.35					T	0.85	0.10		0.40	2.10
Humboldt	T										0.15	T									0.09			0.07							0.31
Independence												0.01									0.20					0.12				0.30	0.63
Indianola											T	1.03								0.38				T		0.16	0.01		T	0.10	1.68
Iowa City												0.08									0.60						0.57			0.50	1.75
Iowa Falls											0.10										0.32			0.01		0.04		0.90			1.37
Jefferson												0.25									0.31					T		T			0.56
Knoxville												0.25									0.25			T		0.35		T		0.12	0.97
Keokuk												0.14									0.89					0.94	0.12		0.04	0.16	2.29
Keosauqua												0.28									0.57					0.21	0.03		0.07	0.08	1.24
La Crosse (Wis)		0.03										0.32	T	T	T				T		0.51	0.01	T			0.41	0.01			0.08	1.37
Le Claire		0.11									0.04	0.11	T								0.45	0.12			0.04	0.62			0.05	0.02	1.56
Larrabee											0.33		T							0.07				0.05				0.25		0.25	0 95
Logan											0.22														0.05					0.26	0.53
Maquoketa	0.18											0.12									0.28							0.18		0.45	1.21
Mason City											T	0.15									0.10				0.03			0.05		0.30	0.63
Maxon												0.12									0.55				0.45		0.06		T	0.05	1.28
Mechanicsville	0.06											0.08	T								0.60					0.30	0.08	0.05		0.45	1.62
Monticello	T											0.20	T								0.50					0.12	0.45	0.03		0.50	1.80
Mt. Ayr											0.10										0.33					0.17		T			0.63
Newton												0.19	T								0.42		T			0.31	0.03	T	0.01	0.47	1.43
Omaha (Neb)												0.32	T								0.05			T	T		T		0.01	0.04	0 43
Osage												0.19									0.27					0.17				0.10	0.73
Oskaloosa												T									0 56					0.48		T	0.20		1.24
Ovid												0.13	T								0.65				T	0.30			0.08	T	1.16
Panama												0.18														0.09		T		0.09	0.46
Richland													0.11								0.73					0.74	T		0.05	0 32	1.96
Rockwell City												0.17									0.10			0.05		0.17				0.23	0.72
Rock Rapids												T												0.10				T		0.20	0.30
Sibley												0.09		T										0.01					0.07		0.17
Sioux City												0.16												0.01					0.17	0.27	0.14	0.75
Spirit Lake												0.18												0.10								0.28
Storm Lake												0.15														0.06		0.62		0.48	0.20	1.68
Tipton													0.10								0 88			T			0.51			0.45	2.00
Vinton	0.03												T								0.33			T		0.45	T				0.81
Washington													T								0.45					T	T			0.45	0.90
Webster City											0.20										0.20			0.03				0.10		0.70	0 20	1.43
Williams											0.18		T								0.35			0.04		0.10				0.70	0.20	1.57

STATIONS.	1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		Mon'y Mean.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Alta	74	40	32	23	49	18	60	22	66	34	70	41	66	45	62	34	63	36	62	39	42	36	32	15	38	10	28	12	35	6	59	28	24	15	32	5	38	15	53	25	40	25	24	10	20	-1	14	-6	35	10	37	32	29	17	37	24	20	8	6	-9	41.6	20.5
Ames	71	34	40	32	..	..	57	14	70	14	72	13	63	26	66	27	65	28	64	28	53	25	37	29	45	20	33	18	38	11	63	20	27	20	33	5	35	19	57	16	45	32	28	16	21	5	15	-3	38	11	34	31	35	31	35	21	24	22	28	11	44.5	20.3
Amana	70	45	41	27	46	16	50	15	63	31	67	31	64	38	58	31	60	30	63	34	63	40	37	27	45	20	34	20	33	14	56	25	31	21	34	9	33	19	54	18	40	34	28	19	19	8	19	1	31	14	34	30	31	35	26	28	21	23	0	-1	43.1	23.2
Atlantic	76	37	55	20	50	10	62	13	78	25	73	26	68	44	72	31	67	22	72	37	66	33	37	26	41	24	32	18	40	10	64	33	28	20	35	6	48	14	56	27	47	30	27	17	25	6	24	2	45	17	34	32	32	25	40	22	35	22	20	-3	48.4	21.2
Audubon	70	33	50	18	48	15	58	18	68	30	69	35	55	42	64	31	62	28	62	35	49	30	33	40	37	20	40	20	32	15	49	9	60	26	43	13	39	20	60	30	46	30	30	16	20	3	21	-2	43	14	39	32	32	28	37	39	24	32	18	25	-4	45.3	21.2
Belle Plaine	71	41	42	24	48	14	52	15	62	31	67	36	68	36	60	32	61	29	65	37	65	42	37	25	46	19	35	17	34	12	58	15	29	19	33	9	34	19	55	17	41	32	29	15	21	7	18	-1	38	13	33	30	35	28	34	26	27	20	22	-5	43.8	21.8
Bonaparte	75	47	65	28	46	15	56	17	68	28	71	36	68	35	60	35	65	29	68	35	67	39	35	27	50	20	38	22	36	14	65	24	48	20	37	13	37	21	56	20	48	32	28	24	25	19	25	4	40	13	35	31	34	32	39	28	40	26	32	7	48.6	24.4
Carroll	72	52	38	26	57	18	58	22	70	24	64	34	66	34	65	33	64	30	62	40	48	32	42	21	40	19	32	15	33	5	60	16	24	18	34	5	37	15	54	22	44	22	26	15	22	0	16	-4	41	5	32	25	34	32	32	25	22	10	11	-5	43.3	19.9
Cedar Falls	75	35	40	30	52	17	57	19	65	29	72	35	71	35	69	30	66	27	65	40	60	40	40	30	45	24	34	18	34	11	56	22	38	20	25	7	37	10	58	18	39	31	25	14	20	4	18	-4	20	10	35	12	30	28	33	19	20	-7	27	7	44.2	20.4
Cedar Rapids	68	48	40	32	46	24	48	22	59	36	64	33	63	42	54	36	58	36	60	36	62	33	40	36	38	26	35	22	32	17	52	28	32	24	34	16	33	24	52	22	40	32	27	22	18	10	16	3	32	16	35	28	35	32	34	26	32	25	25	10	42.1	26.5
Centerville	73	54	67	20	45	22	75	28	70	38	72	38	68	35	62	36	69	41	68	32	40	25	50	20	45	14	49	27	65	33	52	18	45	20	46	22	48	24	50	33	50	24	45	20	37	10	35	6	32	8	36	10	38	12	38	10	37	11	32	2	51.6	23.0
Charles City	70	31	32	31	45	17	56	19	60	29	70	33	65	44	60	40	64	20	64	37	50	36	43	30	36	20	30	16	32	16	50	25	28	16	34	4	34	16	45	22	54	32	22	13	14	3	14	10	32	12	33	30	32	24	32	12	20	16	10	-10	41.0	21.2
Clarinda	70	46	39	32	45	18	57	20	66	34	69	38	63	42	62	35	62	30	62	37	51	32	39	26	44	26	37	21	41	18	60	28	47	19	34	14	45	22	52	26	51	31	31	15	21	8	25	8	41	18	35	22	38	25	39	23	32	23	28	-2	46.2	24.2
Clinton	73	52	61	28	45	18	50	17	63	25	69	29	66	32	53	34	56	32	64	31	67	36	54	29	44	21	35	21	33	14	53	26	47	24	36	12	35	18	52	15	38	32	37	19	30	10	15	1	31	12	34	27	37	32	35	27	35	20	24	4	45.4	23.3
College Springs	68	28	42	20	48	22	61	34	72	33	71	40	64	36	65	37	66	35	65	39	52	35	44	28	46	24	38	16	43	15	61	31	30	19	36	12	46	17	56	34	52	36	34	19	28	7	26	6	36	16	44	32	43	20	42	20	40	23	42	10	48.7	24.4
Corning	72	44	60	32	49	13	60	18	72	32	71	41	64	42	68	32	65	27	64	39	58	35	40	29	45	24	40	19	43	15	64	29	55	20	37	11	47	21	56	28	53	32	35	21	25	7	25	4	44	16	40	32	41	32	40	24	38	22	28	2	50	0	24.8
Cresco	72	34	35	22	47	19	53	19	63	32	68	34	60	39	64	32	62	30	61	38	59	37	37	24	39	22	28	16	29	13	53	24	24	16	33	5	32	17	35	18	38	28	17	7	10	0	12	12	26	4	32	22	34	25	32	15	28	9	9	-10	40.4	19.0
Davenport	71	56	44	33	43	25	51	24	63	36	68	39	64	82	57	40	62	33	64	41	56	43	39	32	45	27	36	24	32	17	57	23	44	25	33	15	34	24	54	24	41	33	28	22	20	9	15	4	34	15	34	30	35	33	49	28	34	24	26	10	44.5	27.9
Decorah	72	33	37	20	49	18	53	27	65	26	79	39	63	29	64	27	64	29	62	42	61	32	38	24	42	18	39	13	30	26	52	25	47	8	32	20	32	18	55	31	56	21	22	7	12	-7	12	-6	32	10	33	31	35	21	33	20	22	10	10	-13	42.8	20.0
Des Moines	72	45	40	33	47	18	58	20	70	37	71	37	63	42	64	35	64	33	64	41	54	42	38	32	44	25	35	21	38	14	65	26	29	21	35	12	38	24	57	26	46	34	30	20	22	7	19	2	40	16	35	32	38	34	37	28	30	24	25	1	45.6	26.0
Des Moines (5½ miles southeast of)	73	44	64	28	48	15	56	17	66	35	72	34	65	34	66	34	64	33	64	39	59	39	58	30	44	22	44	20	40	11	63	24	55	22	36	11	42	22	47	24	45	33	38	18	15	6	19	0	38	15	34	25	31	31	34	27	23	23	22	2	47.3	23.8
Dubuque	72	52	43	33	48	22	52	23	64	36	70	34	65	41	57	39	61	33	63	38	64	42	38	31	47	26	32	20	31	16	52	28	38	24	32	14	34	24	55	22	38	32	26	21	16	11	14	-1	26	10	34	24	36	32	36	27	30	20	20	5	42.4	26.1
Elkader	73	35	41	24	50	18	55	17	68	27	70	25	65	38	69	29	67	30	63	33	63	40	41	24	45	22	30	20	32	15	55	23	32	20	33	9	37	17	58	15	37	30	26	15	17	6	17	-4	30	9	33	24	37	28	35	22	28	15	17	-8	44.1	20.6
Emmetsburg	76	24	58	22	50	12	62	15	68	15	72	27	68	32	64	30	65	28	63	35	46	12	36	22	37	21	28	13	32	-7	64	18	44	12	34	5	37	10	37	12	40	25	27	11	20	0	12	-6	33	7	34	30	35	23	32	12	28	7	17	-8	44.6	15.6
Galva	74	34	60	24	60	17	60	21	67	31	71	35	66	56	61	29	65	28	62	29	50	32	32	15	35	15	31	14	36	9	58	35	46	15	35	15	41	15	53	26	41	29	29	14	19	11	13	-4	42	12	39	31	34	19	34	24	32	17	17	-3	45.4	21.5
Glenwood	77	46	74	28	54	18	66	25	76	37	86	40	70	44	72	34	52	34	70	28	54	34	52	24	46	28	48	26	50	18	68	34	52	20	42	12	52	21	72	30	58	32	34	20	26	8	30	4	46	18	40	34	38	26	42	18	46	22	18	2	54.6	25.3
Greenfield	75	45	53	30	48	19	58	21	71	34	70	42	65	40	65	37	64	38	65	38	55	33	37	24	44	23	35	16	29	10	62	25	58	18	37	14	42	19	55	23	49	30	33	15	23	4	26	-1	48	13	39	32	41	25	42	26	35	20	26	4	48.4	23.6
Grinnell	68	52	62	31	48	26	52	22	62	35	68	40	65	40	60	40	61	40	61	42	60	45	35	29	40	23	33	21	33	14	59	24	53	23	53	14	32	20	54	24	42	..	29	..	20	..	16	..	35	..	32	31	33	30	33	28	33	22	24	0	45.3	28.9
Grundy Center	72	30	37	18	51	20	54	21	67	36	69	35	62	33	65	32	64	34	64	37	55	30	37	23	44	17	32	11	35	11	58	19	27	8	34	8	34	18	56	24	41	16	26	5	19	-4	16	-4	31	10	34	30	33	19	33	20	30	15	15	-9	43.2	18.7
Hampton	73	35	35	21	50	19	50	21	67	35	71	39	61	39	65	32	66	33	63	38	50	32	36	23	40	23	30	15	33	10	56	21	21	17	33	7	32	15	36	17	38	26	23	11	18	4	14	-5	30	9	33	29	32	25	32	14	20	17	12	-9	41.1	23.0
Independence	72	38	64	31	49	16	53	18	64	28	65	32	63	33	63	34	64	28	63	36	60	41	55	31	46	22	35	18	32	12	55	21	54	21	32	8	33	19	56	16	45	31	39	17	23	4	16	-4	27	10	36	25	34	31	34	19	23	18	22	-10	46.4	21.5
Indianola	..	..	69	31	42	38	53	50	63	61	72	31	62	38	65	35	64	34	63	39	55	52	50	..	44	23	37	30	38	13	66	39	58	22	66	26	38	12	66	26	47	35	40	21	..	6	22	0	42	15	41	38	37	36	40	26	38	14	29	3	48.6	26.7
Iowa City	74	48	64	34	50	15	57	16	67	27	71	29	68	35	57	31	64	32	65	32	67	40	61	35	47	20	41	20	35	15	58	25	54	25	37	13	35	19	57	16	46	33	40	22	27	9	25	2	32	14	32	27	36	32	36	28	31	23	24	20	48.6	24.7
Iowa Falls	72	33	52	19	52	18	57	17	68	30	70	31	62	36	65	30	63	26	61	36	47	32	25	24	40	20	32	14	31	9	58	21	45	15	33	5	32	14	45	19	40	26	25	5	16	2	12	-7	30	9	..	..	32	23	32	14	31	17	32	-7	43.8	18.3
Jefferson	68	45	70	30	50	15	60	15	65	30	60	30	65	30	65	35	65	37	50	25	45	25	40	15	40	35	60	20	60	20	40	25	40	20	55	20	55	35	55	15	25	3	20	5	40	10	33	12	40	30	40	25	35	17	25	7	50	0	23.0
Knoxville	71	48	40	34	41	20	56	19	66	38	71	35	65	38	60	32	62	32	64	39	63	45	31	30	44	22	36	19	36	12	64	20	30	24	34	11	35	21	55	18	46	33	34	19	17	6	21	2	36	14	36	31	36	31	37	27	36	28	24	2	44.9	24.9
Keokuk	74	56	47	36	47	23	54	27	66	35	69	40	66	58	61	40	64	36	68	40	68	44	39	32	48	28	38	15	67	31	45	28	37	32	32	13	25	7	40	16	38	23	36	24	49	32	32	24	37	32	32	28	34	28	35	16	49	0	29.0
Keosauqua	74	51	65	33	44	19	57	19	70	27	73	35	66	39	60	37	68	31	67	35	65	40	44	31	51	23	41	24	57	16	65	27	51	24	39	15	39	23	58	21	49	35	36	26	26	12	25	7	39	16	35	32	35	33	39	30	39	25	30	23	49.6	26.9
La Crosse (Wis)	72	39	38	32	50	25	54	26	65	40	69	33	64	46	65	37	66	34	64	34	64	42	38	30	43	26	28	22	32	18	52	27	36	23	34	14	40	24	58	22	40	34	26	20	14	8	11	-5	23	-1	36	13	36	32	36	26	24	15	12	-1	43.0	24.5
Larrabee	74	34	43	21	54	19	61	21	68	32	72	39	70	47	63	29	64	31	63	39	49	30	32	12	37	18	26	11	38	8	60	25	39	14	36	5	38	12	55	24	45	27	27	17	20	-1	14	-7	37	11	42	21	39	16	32	24	30	6	20	-9	40.9	19.0
Logan	75	45	32	26	52	20	60	28	70	32	72	40	68	46	64	32	66	30	64	42	44	32	42	24	44	20	46	15	61	28	29	18	35	10	48	26	28	16	50	28	46	35	26	18	16	2	46	17	44	32	40	32	34	20	26	7	28	20	13	0	45.4	24.7
Mason City	66	..	64	..	69	..	54	..	61	..	69	..	62	..	63	..	62	..	50	..	57	..	40	..	38	..	31	..	54	..	26	..	32	..	29	..	52	..	38	..	37	..	14	..	16	..	30	..	34	..	34	..	33	..	30	..	10	..	43.3	....
Mechanicsville	69	45	41	35	46	27	50	20	54	29	67	33	63	34	50	31	66	33	62	35	63	34	35	32	45	22	33	10	31	14	32	24	32	21	33	10	32	22	54	17	34	32	24	13	16	7	15	-1	29	10	34	25	34	31	34	24	29	21	23	11	42.0	24.2
Newton	71	45	45	30	48	17	54	16	56	34	70	31	64	34	62	33	63	29	65	35	59	35	38	28	44	26	34	18	37	11	63	21	53	19	33	10	34	20	56	20	45	32	32	18	22	5	18	-2	37	13	36	30	35	31	33	26	34	20	24	-5	46.1	22.5
Omaha (Neb)	71	47	40	27	50	24	63	28	72	37	72	44	64	47	63	40	64	38	63	41	44	33	37	23	43	29	32	21	44	20	62	31	27	21	36	16	46	25	56	30	50	33	25	20	23	10	29	9	43	19	38	34	34	29	40	20	30	19	31	0	46.4	26.5
Oskaloosa	73	49	62	26	50	13	56	13	68	25	71	34	68	36	61	31	64	26	66	38	65	43	43	25	45	21	36	21	38	13	63	24	53	21	35	11	37	20	58	23	48	35	35	19	21	9	22	3	39	15	36	32	35	30	36	28	36	25	25	0	48.2	23.6
Ovid	72	48	47	24	45	10	60	17	70	34	72	38	63	37	66	32	65	29	66	41	68	42	41	30	52	22	39	18	41	11	67	28	39	28	37	10	46	20	57	23	50	32	33	21	25	7	24	2	44	15	33	31	35	32	42	26	38	25	30	1	48.9	24.7
Panama	72	38	56	25	49	17	66	18	70	31	71	39	65	44	65	54	64	31	62	37	51	32	34	18	39	24	30	17	43	14	60	25	44	18	34	8	44	17	55	26	46	30	31	15	20	5	25	2	42	16	36	33	36	24	38	23	34	17	27	-4	47.0	23.1
Rock Rapids	71	29	51	17	34	26	52	34	64	28	71	30	72	25	72	46	64	26	66	38	64	34	65	17	60	18	27	13	50	9	40	14	25	13	35	3	37	13	40	14	37	10	30	13	25	-5	20	-2	30	1	30	25	37	28	30	25	25	5	24	-6	45.2	18.0
Sibley	74	32	61	17	47	20	58	17	62	35	70	2	64	42	59	25	60	29	60	40	50	62	37	12	37	15	27	10	38	3	50	22	48	11	35	-1	27	8	54	19	40	27	27	9	18	-3	14	-9	32	..	25	24	32	32	32	24	30	5	..	..	43	4	17.5
Sioux City	72	36	38	22	53	24	66	22	70	32	73	40	67	48	64	32	67	31	61	40	39	32	38	19	43	27	32	20	42	17	64	29	25	13	41	12	43	19	56	32	44	30	24	17	23	4	22	0	42	16	40	27	35	18	32	23	21	10	10	-4	44.9	22.9
Spirit Lake	77	35	57	22	50	21	62	20	68	32	72	40	65	43	61	28	66	37	64	38	60	32	41	17	40	22	31	13	47	17	52	12	45	10	39	6	36	6	48	28	43	22	32	-2	30	-1	12	8	32	10	39	19	36	22	30	15	24	4	13	-13	45.7	18.8
Storm Lake	70	40	62	24	50	24	57	27	66	36	67	39	65	41	62	34	60	37	60	39	54	33	38	25	38	25	34	16	35	10	54	28	42	16	33	9	39	17	50	26	46	34	24	14	20	1	12	-3	34	9	38	32	37	21	32	21	32	10	20	3	44.6	22.9
Tipton	68	26	70	20	45	20	51	41	63	39	69	37	30	61	39	37	60	39	63	45	35	38	23	46	24	35	21	33	15	55	24	42	26	35	12	34	21	54	20	40	32	35	15	17	8	19	0	34	21	54	20	40	32	35	15	27	29	24	20	14	44	18	24	8
Villisca	65	39	70	40	65	37	68	36	70	42	64	38	63	34	70	42	65	40	58	35	60	36	55	37	48	33	48	28	46	24	45	20	58	25	30	11	40	25	50	24	49	22	38	8	22	5	28	7	44	17	38	32	28	20	42	22	30	23	34	-3	50.1	26.6

IOWA PRECIPITATION CHART NOVEMBER 1893



MEAN TEMPERATURE NOVEMBER 1893.



METEOROLOGICAL STATIONS AND OBSERVERS.

From the following, weekly and monthly reports of Meteorological data are received by the Iowa Weather and Crop Service.

Albia	Gus Johnson.
Algona	C. D. Pettibone.
Alta	D. E. Hadden.
Amana	Conrad Schadt.
Ames	E. C. Dickinson.
Ames	W. H. Heileman.
Ames, (4 miles S. W.)	Isaac Young
Atlantic	J. W. Love.
Audubon	J. F. Hocker.
Belle Plaine	H. W. Vandike.
Blakeville	James Rodgers.
Blockton	C. W. Thompson.
Bonaparte	Hon. B. R. Vale.
Carroll	Moses Simon.
Cedar Falls	Prof. A. C. Page.
Cedar Rapids	H. D. Olds.
Centerville	Prof. H. E. Reister.
Charles City	J. W. Smith.
Clarinda	A. S. Van Sandt.
Clinton	Luke Roberts.
College Springs	A. A. Berry.
Corning	John W. Bixby.
Cresco	Gregory Marshall.
Council Bluffs	E. W. Hart.
Davenport	*F. J. Walz.
Delaware	Wm. Ball.
Decorah	L. H. Baker.
Denison	P. H. Schlumberger.
Des Moines	*Geo. M. Chappel, M. D.
Dubuque	*S. C. Emery.
Eagle Grove	C. A. Schaffter.
Eldora	Prof. C. F. Woodward.
Elkader	Chas. Reinecke.
Emmetsburg	H. Conroy.
Fairfield	J. Fred Clarke, M. D.
Fayette	R. Z. Latimer.
Ft. Madison	Miss L. A. McCready.
Fulton	J. W. Eckles.
Galva	W. A. Crowley.
Glenwood	Seth Dean.
Greenfield	J. G. Culver.
Grinnell	Prof. S. J. Buck.
Grundy Center	Chas. G. Rogers.
Hampton	E. C. Grenelle.
Hawkeye	J. W. Bopp.
Hopeville	M. T. Ashley.
Hopkinton	Theo. Marks
Humboldt	J. W. Foster.
Independence	E. F. Wulfke.
Indianola	Prof. J. L. Tilton.
Iowa City	Prof. A. L. Arner.
Iowa Falls	J. B. Parmelee.
Jefferson	Dr. Chas. Enfield.
Keokuk	*Fred. Z. Gosewisch.
Keosauqua	Prof. J. H. Landes.
Larrabee	H. B. Strever.
Logan	Mrs. M. B. Stern.
Mason City	H. I. Smith.
Marshalltown	L. S. Kilborn.
Maquoketa	Dr. A. B. Bowen.
Mechanicsville	Rev. J. W. Hubbard.
Mooar	F. G. Thomas
Monticello	Henry D. Smith
Mount Vernon	Prof. A. Collin.
Mt. Ayr.	Hon. Wm. Shriver.
Murray	A. W. Lewis.
Muscatine	J. P. Walton
Newton	A. Lufkin
Omaha, Neb	*Geo. E. Hunt.
Ovid	H. C. Miller.
Osage	G. D. Pattingill
Oskaloosa	Jos. Boyd.
Panama	Wm. J. Wicks.
Postville	F. L. Williams.
Richland	Wm. A. Shaffer.
Rock Rapids	W. C. Wyckoff.
Rockwell City	G. B. Rigg.
Seymour	Mrs. C. A. Conger.
Sibley	H. G. Doolittle.
Sidney	G. V. Swearingen.
Sioux City	*U. G. Pursell.
Sac City	Dr. C. Brown.
Spirit Lake	H. C. Drummond
Storm Lake	A. J. Bond.
Tipton	J. M. Rider.
Vinton	T. F. McCune.
Villisca	M. M. Stoddard.
Washington	Wm. A. Cook.
Webster City	C. M. Trumbauer.
Winterset	Will McKnight.
West Bend	Phil. Dorweiler
Williams	M. L. Fuller.

*U. S. Weather Bureau.

WEATHER-CROP OBSERVERS.

Reporting for the Weekly Bulletin.

Afton	M. V. Ashby.
Agency	J. H. Van Zant.
Albia	Wm. Mercer.
Alta	Hon. H. T. Saberson.
Ames	Henry C. Wallace.
Anita	H. T. Chapin.
Ankeny	Ed. Parmenter.
Battle Creek	A. Preston.
Bloomfield	Geo. Duffield.
Boone	L. C. Morris.
Carbon	N. M. King.
Carson	G. N. Ferguson.
Centerville	Henry Galley.
Charles City	W. B. Towner.
Chariton	C. C. Burr.
Clarksville	F. M. Russell.
Corning	Jerome Smith.
Clermont	Chas. Larrabee.
Concord	J. M. Elder.
Council Bluffs	L. Prouty.
Dedham	J. W. Kay
Danville	Sherman Matthews.
Emerson	D. B. Nims.
Ely	Hon. A. J. Fuhrmeister.
Fontanelle	W. H. Bridgman.
Ford	W. W. Whitmore.
Fort Dodge	R. W. Blaine.
Geneva	Wm. H. Thompson.
Gosport	B. F. Banta.
Grand River	Dr. John Daykin.
Grinnell	A. O. Price.
Harlan	Fred Fischer.
Hesper	G. E. Dillingham.
Hodge	James Piper.
Hamlin	F. P. Moore.
Humeston	Hon. S. H. Moore.
Independence	C. L. Thomas.
Indianola	T. B. Hammer.
Jefferson	S. M. Taylor.
Larrabee	H. H. Carnahan.
LeMars	Hon. Henry Schrooten.
Ledyard	Frank Miller.
Lawler	Hon. Wm. Glattly.
Lockridge	John F. Farman.
Manning	H. W. Pollock.
Mapleton	A. Lamb.
Marshalltown	Hon. J. G. Brown.
Mason City	Wm. Nettleton.
Mt. Pleasant	W. S. Wright.
Milton	Hon. E. C. Holland.
Mount Vernon	Robert Smith.
Newton	J. P. Beatty
North English	J. L. Williams.
Nevada	O. G. Ashford.
Osage	E. W. Stacy.
Orange City	H. J. VandeWaa.
Paton	Hon. Joshua Jester.
Pittsburg	G. C. Duffield.
Polo Station	A. E. Miller.
Prescott	G. W. Iden
Paullina	Geo. Hakeman.
Rockwell City	J. G. Palmer.
Rock Rapids	D. E. F. Merrill.
Rossville	F. B. Wiley
Sandusky	Z. Hollingsworth
Sageville	Hon. F. N. Knoll.
Shenandoah	Reuben Mullison.
State Center	E. N. Thompson.
Sumner	John Dawson.
Tama	W. G. Malin.
Van Horn	Spencer Smith.
Wapello	O. P. Smith.
Waukee	John Wragg
Wheatland	D. Beckman.
Willow Creek	W. S. Nicholson.
Winterset	H A. Kinsman.
Wall Lake	F. E. Wilcox.
Walnut	F. L. Martin.
What Cheer	O. D. Lawrence.

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UNITED STATES DEPARTMENT OF AGRICULTURE
WEATHER BUREAU.

MONTHLY REVIEW

OF THE

Iowa Weather and Crop Service

VOL. IV.—DECEMBER, 1893.—NO. 12.

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CENTRAL STATION, DES MOINES, IOWA.

J. R. SAGE,
DIRECTOR.

GEO. M. CHAPPEL, M. D.,
LOCAL FORECAST OFFICIAL,
U. S. WEATHER BUREAU, ASS'T DIRECTOR.

DES MOINES:
G. H. RAGSDALE, STATE PRINTER.
1893.

THE IOWA WEATHER AND CROP SERVICE.

Was established by act of the Twenty-Third General Assembly, and placed under supervision of the Board of Directors of the State Agricultural Society, constituted as follows:

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U. S. Department of Agriculture---Weather Bureau.

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MONTHLY REVIEW

OF THE

IOWA WEATHER AND CROP SERVICE.

VOL. IV.] DECEMBER, 1893. [NO. 12.

EDITORIAL NOTES.

Iowa has 911,100 pupils of school age, and these are the most valuable products of the State. For their instruction the State employs 28,401 teachers (23,564 women, and 4,837 men), whose yearly salaries amount to $4,798,323 41. The school houses are very close together in Iowa.

***

Low prices of soil products this year are not the result of over-production, but of under-consumption. And this from necessity, not choice.

***

The principal sanitary influence of forests is regarded by B. E. Fernow as depending not upon the production of oxygen and ozone, nor upon the protection afforded against sun and wind, but upon the unfavorable character of the covered soil for the development of disease germs, especially those of cholera and yellow fever, and upon the comparative absence of dust, in which such organisms are carried into the air. As a climatic factor, the position of the forest is still uncertain, but its relation to water and soil conditions is well established. In its effect upon climate, the forest of the plain appears to be of more importance than that of the mountains, where the influence of elevation is so much more powerful. As a water regulator, however, the forest of the mountains is the important agent. The water controlling influence is so great, and makes itself felt so far from the location of the forest, that the claim for government ownership or control of the mountain forests is fully justified,

***

In a recent lecture on "The Leaf and Its Functions," Professor S. H. Vines, of Oxford University, England, referred to the enormous quantity of water drawn by the roots from the soil, and by this means discharged into the atmosphere. For example, the common sunflower was found to exhale twelve ounces of water in twelve hours, and an oak tree, with an estimated number of 700,000 leaves, would in the same way give off something like seven hundred tons of water during the five months it carries its foliage. While the other parts of plants varied but little in their conditions, the leaves, as being the most important organs of vegetable life, were able to alter themselves to suit the conditions under which they had to live, so that botanists were often able, by the appearance of a plant, to tell the climate and circumstances under which it had been grown.

From these facts an inference may be drawn as to the value of forestry in mitigating the severity of drouths and hot winds.

***

On account of the pressure of private affairs, increasing age and declining faculties, Mr. A. J. Bond, of Storm Lake, has resigned his position as voluntary observer, after many years of faithful work in this line of public service. We regret exceedingly to sever relations which have been so pleasant, and we sincerely hope Mr. Bond will enjoy for many years the fruits of a busy and useful life.

***

Hon. C. E. Whiting says that with one-fifth of his farm in shelter belts he can raise more grain and grass than can be grown on the whole of an adjoining farm of equal size in open exposure.

***

Prof. A. Woeikof, of the University of St. Petersburg, in a letter to the *American Meteorological Journal*, says the meteorologists of Europe are now practically agreed in the opinion that dynamic cooling is the most important cause of rainfall. Mr. W. accepts as correct the classification of rainfall as convective, orographic and cyclonic.

***

There is no more encouraging sign of the growing interest in meteorology in the United States, says the *American Meteorological Journal*, than the rapid increase during the past year or two of the State Weather Services. These services are now established in every part of the United States, except Alaska, and with their network of observers are collecting valuable data for future study.

***

Iowa stands first in the list of hog producing states with about 7,000,000 head valued at $41,500,000. Thi

added to $32,000,000 for butter, in which the State also leads, shows us how these two departments of the farm grow together. They fit into each other admirably, and complement each other. The crops that the cow requires to do her best work suit the hog to a great extent. The by-products of the dairy in a corn growing section are exactly what the hog needs to grow on from birth until the corn is in roasting ears where it will finish him for the market. It is well known that hogs about the dairy are much more healthy than on farms where no milking is done. The reason is obvious; he is more naturally nourished. It is evident that along these lines the farmer must look for prosperity and the statistics show us that our farmers are beginning to understand the situation. Farm history clearly indicates how success comes, and what the farm imperatively requires to insure it. The cow must be its center figure.—*Farm and Dairy.*

***

Raising 1,000 bushels of corn on ten acres is much more profitable than raising a like amount on forty acres. This is a fair illustration of the advantage of intensive farming.—*Western Farmer and Stockman.*

***

W. M. Bomberger, of Harlan, declares that the grape can be as easily raised, and is as sure a crop in Northwestern Iowa as corn, and that the time is coming when it will hold the same position among fruits that corn does as a farm crop.

***

The *Homestead* concludes that it does not pay to feed good corn to poor grades of stock.

***

The *Homestead* says: "The report of the State dairy commissioner, which has recently been sent to the governor, indicates that the butter and cheese produced in the State of Iowa during the past year falls below the amount produced the year previous. This decrease in production is undoubtedly partially due to the drouth during the past season and the consequent shortage of feed for the cows in milk. About a year ago we urged the readers of this department to set aside a piece of ground for the purpose of growing soiling crops to meet just such a drouth as came upon us. Some whom we have met since took this advice and thanked us for it. Others did not and their cows suffered. The winter is the time for planning the next season's crops, and at the risk of being considered "cranky" on this subject we again urge that every one of our readers select a few acres to be devoted to soiling crops to help tide over short pastures next summer. What crops should be sown depends somewhat upon locality and we will discuss this matter during the next two months. It might be well to say that the Iowa experiment station will shortly issue a bulletin on the subject and it might be well to write for it, addressing Prof. James Wilson, Ames, Iowa."

***

In a communication to the *American Meteorological Journal*, Mr. John H. Eadie, of Bayonne, N. J , considers the question, "are our winters becoming milder?" and arrives at the conclusion that the records, covering more than a century, show but slight variation in the mean temperature of that section. The same result will be reached by study of the records of any portion of our country.

***

Reports are received now and then concerning the successful operation of rain-makers in the western states. As a rule, however, the statements are ambiguous, and on this account, are unreliable. It goes without saying that no rain can be produced unless the water is in the air, and this subject was fully explained at the time of Dyrenforth's ludicrous experiments at the government's expense a few years ago. We question, too, whether the so-called rain-makers do not always take advantage of natural conditions, not generally known to the uninitiated. The *Orange Judd Farmer* would like to hear from any of its subscribers who have *witnessed* the operation of these "Sons of Pluvius," with a full statement of natural conditions existing at the time the rain was said to have been produced.—*Orange Judd Farmer.*

***

Kaffir corn, which is a non-saccharine sorghum, is a desirable forage crop, and the grain is valuable. Prof. Holter, of Oklahoma, says the yield of fodder in some of the western states is six tons per acre.

***

Prof. Atkinson, of the botanical department of Cornell University, maintains that plants sometimes suffer from dropsical diseases, or excessive turgescence. This conclusion was reached as a result of careful experiments.

***

The Weather Bureau is about to undertake certain investigations in the line of medical climatology, to determine the effects of weather conditions in the production of prevalent or epidemic diseases. If this work is systematically and thoroughly done, it may lead to results as valuable to the general public as anything that has been accomplished for the benefit of agriculture and commerce.

***

The word "zero" is from the Spanish and means nothing. Here is a story about its first use for a thermometer in 1795, by a Prussian merchant named Fahrenheit. From a boy, Fahrenheit was a close observer of nature, and when only ten years old, in the remarkably cold winter of 1709, he experimented by putting snow and salt together and noticed that it produced a degree of cold equal to the coldest day of the year. And that day being the coldest day that the oldest inhabitants could remember, Fahrenheit was the more struck with the coincidence of his little scientific discovery and hastily concluded that he had found the lowest degree of temperature known in the world, either natural or artificial. He called the degree zero and constructed a thermometer, a rude weather glass, with a scale graduating up from zero to boiling point, which he numbered 212, and freezing point 32, because, as he thought, mercury contracted at thirty-second of its volume on being cooled down from the temperature of freezing water to zero, and expanded the one hundred and eightieth on being heated from the freezing to the boiling point.—*Ex.*

METEOROLOGY AND THE FARMER.

The August number of the "Cosmopolitan" contained an article entitled "Meteorology and the Farmer," by Col. S. E. Tillman, U. S. A., who evidently has no faith in the "rain-doctors." He says:

"In only one other branch of science have there been greater advances since 1850 than in meteorology. Especially is this so as regards the motions of the atmosphere which bring about our rain and snow-storms, the cyclones, terrific tornadoes, and remarkable cloud-bursts. While the progress has been extraordinary and the advances of the utmost importance, the spread of knowledge upon this subject among the people has hardly begun. The fact is forcibly illustrated by the number of charlatans parading as rain-doctors in the rich but arid regions of the west, where, if newspaper reports are to be relied upon, they have occasionally succeeded in perfecting contracts with the entire population of a county. Less than two years ago the government sent out its own rain experimenters and one of the great magazines published a duet entitled, 'Can we make rain?' one of the writers being the government's chief rain-producer and the other an astronomer of world-wide repute. In this discussion the cause of general rains was referred to an agency recognized and declared as inefficient by recent meteorology. The general principles involved in great rain-storms are well understood by modern meteorologists and cannot fail to interest and be of use to every reader of the "Cosmopolitan."

"When moisture-laden atmosphere, from any reason, ascends sufficiently, the pressure to which it is subjected is diminished, it expands and is thereby cooled and its moisture condensed. When this condensation takes place with sufficient rapidity it rains or snows, otherwise only clouds are produced. *Clouds* may be produced in other ways, but not *rain*. The ascent of the air which produces rain is generally brought about in one of two ways: first, if the prevailing winds blow over high mountains, they will, in the passage, be deprived of their moisture. Thus are produced the heaviest annual rain-falls of the earth. Second, when the atmosphere over any portion of the earth's surface becomes warmer or lighter than over the surrounding areas, it ascends just as the air does in a hot chimney, and in the same manner, too, it draws in the adjacent air and the whole is carried aloft to be expanded, cooled, and deprived of its moisture, with great liberation of heat, which heat keeps the draught in operation.

"In this way are produced all the general rains of the eastern United States. The air over nearly all the region east of the Mississippi is often involved in the same storm. In such storms, flowing from all sides toward the central flue, the air is swerved to the right by the earth's rotation, and the whole becomes involved in one great whirling mass, the central portion ascending as it circles around the flue. These large revolving storms are the cyclones of the meteorologist. Their width is many hundred times their height. When the height of a storm is great as compared to its width, and the velocity of the circling winds very great, it becomes a tornado; these the papers commonly call cyclones, but improperly so The ordinary thunder-storm is much less severe than a tornado and much less extended than a cyclone. From these well established facts of modern meteorology it is readily understood how inefficient are any means yet employed to imitate nature's storms. In a very moist atmosphere it might be possible to produce draught enough for a little rain. In the arid regions of the west the moisture is not present to continue the draught even if begun, and no one who thoroughly understands the causes of rain-fall would be willing to attempt it. The idea that cannonading, or any other sounds, can produce rain is absurd in the highest degree. The unfortunate farmer throws away money when he gives it to a rain-doctor."

NATIONAL BULLETIN FOR DECEMER, 1893.

WASHINGTON, D. C., January 2, 1894.

TEMPERATURE.

The month of December was warmer than usual throughout the southern states and over the Rocky mountain, the plateau and the Pacific coast districts. The departures from the normal temperature in the districts east of the Mississippi were very slight, and in no case exceeded 3° per day. In northern Georgia, central Tennessee, and from Virginia to New York the normal temperature prevailed. From Texas northward to Nebraska the excess in temperature ranged from 3° to 5° per day, and in western Montana and Idaho the excess was more marked, ranging from 3° to 8°. Generally in the states on the Pacific coast the temperature was in excess but the departures from the normal were slight.

Over the northern portions of the country extending from New England westward to the Dakotas the month was colder than usual, the deficiency ranging from 3° to 6° per day in northern New England, the upper lake region and the upper Mississippi valley. Over Minnesota and the eastern portion of the Dakotas, the lowest mean temperature of the month occurred, and in extreme northern Minnesota it was 10° colder than usual.

The week ending December 4th was decidedly cold throughout the central valleys and lake region, while it was slightly warmer than usual on the Atlantic and Pacific coasts.

The week ending December 11th was colder than usual throughout the regions east of the Mississippi and in the northwest, but it was a warm week on the Pacific coast and over the northern and central plateau regions.

The week ending December 18th was moderately cold generally throughout the northern states east of the Rocky mountains, while the temperature was slightly in excess generally throughout the southern states.

The week ending December 25th was unusually warm over the entire country, including the Rocky mountain districts and thence eastward to the Atlantic coast, the daily excess in temperature throughout the lake region and the central valleys ranging from 6° to 15°, the only portion of the country showing a deficieny of temperature for this week being Nevada, California and western Arizona, where the average temperature differed but slightly from the normal.

PRECIPITATION.

The month of December was usually dry throughout all districts south of the lake region and in the interior of the middle Atlantic states. Over the greater portion of

this region the deficiency in rainfall exceeded one inch, and over the greater portion of Louisiana and Arkansas, and the southern portions of Alabama and Georgia, the deficiency in precipitation ranged from two to three inches. The only portions of the southern states where the precipitation was in excess were small areas on the coast of South Carolina and possibly in central North Carolina.

There was also a general deficiency of rainfall in the plateau regions and on the Pacific coast. In northern California, and over the greater portions of Oregon and Washington, from 50 to 60 per cent of the usual amount of rain fell, while in southern California the precipitation ranged from 75 to 80 per cent of the normal; in northwest Washington the rainfall was near the normal. There was a slight excess of precipitation over the greater portion of New England and in northern New Jersey.

The precipitation throughout the lake region and thence westward to the Rocky mountains was in excess, generally in the form of snow, leaving the ground covered at the close of the month. The snowfall was very heavy in the northern portion of the lake region, and the excess of precipitation over the greater portion of Michigan, Wisconsin and eastern Minnesota ranged from one to three inches.

The following notes accompany the snow chart issued by the Weather Bureau for the week ending January 1:

From Michigan eastward to the Atlantic coast the southern limit of snow at 8 P. M., January 1, 1894, was generally from 100 to 250 miles farther south than was shown on the chart for the previous week; the southern limit over the central plateau region was also somewhat farther south than for the previous week, while from northeastern Colorado to the western shore of Lake Michigan it was farther northward by from 50 to 200 miles.

Over the extreme northern districts from Idaho eastward to the Dakotas, and from the lake region to the Atlantic coast the depth of snow at 8 P. M., January 1, was greater than at the same hour December 25, 1893, the greatest increase occurring over the northern portions of Michigan and Wisconsin and along the New England coast from Massachusetts to southern Maine, where there were from four to six inches more snow than was indicated on the previous chart.

The month closes with the winter-wheat belt practically exposed, the area covered by snow at the close of the month following the southern boundary of Michigan westward to northern Iowa and thence to the Rocky mountains. Winter wheat has been subjected to marked variations in temperature, freezing and thawing, with little frost in the ground; but as yet no marked deficiency in moisture exists north of the Ohio river, but the ground is dry in the lower Missouri valley and in eastern Kansas.

MARK W. HARRINGTON,
Chief of Weather Bureau.

PLANTING FOREST TREES.

On this subject Prof. L. H. Pammel, writes the *Orange Judd Farmer*, as follows:

"Western farmers urge that the planting of forests as a financial investment is a poor one. Ask farmers of the agricultural State of Iowa to set aside a few acres for forest culture and more than ninety-nine per cent of them will refuse. Agricultural lands in this prairie State are of more value than wooded areas, and as long as this condition of affairs continues, little need be expected. Yet there are many places in this and other States which could and should be planted with forest trees. Along the rivers and streams are small hills unfit for ordinary agricultural purposes, while much of the bottom land had better be left covered with forest trees. These low grounds contain the most valuable trees, such as walnut, the hickories hackberry and sycamore.

"The question of forest preservation and legislation in New York, Pennsylvania and the New England States becomes a very different question. Much of the land there is not valuable for agricultural purposes, and consequently is cheaper than Iowa land. Pennsylvania and New York have made some advances in forest legislation, and if reports are to be relied upon, these States will receive considerable revenue from the products of forests. It is certain that the value of old abandoned farms in the Eastern States would be much increased if again supplied with timber. There is more profit in farming ten acres in Iowa than forty acres in these States; this is especially true of the cereals. Notwithstanding these facts, it seems advisable for every farmer, eastern or western, to plant a small grove. Let it be general in one or several States and not local.

"'Abandoned Farms and Wasted Forests' is the subject of an able editorial in *Garden and Forest*, from which the following is taken: 'We cannot measure accurately the effect of forest areas upon adjacent cleared land in modifying summer or winter winds, in mitigating extremes of heat and cold and distributing the annual supply of water. But it certainly is a wasteful practice to clear the timber from soil which can produce nothing else with profit, and yet this squandering of our inheritance is going on to-day in the eastern part of the United States as rapidly as if there was not an abandoned farm in all the country to sound a warning against such improvidence.'"

THE IOWA WINTER.

Winter in northern countries is the great reservoir of health and strength. This fact has been demonstrated in all ways, the nearer you go to the tropics the less you find men endowed with the power and endurance that men ought to have. Here in Iowa, well up under the dipper in the northern sky, with the north star high over our heads, we have a tempestuous and wild winter, and sometimes in forgetful moments we long for the winter of such enchanted lands as Italy or Mexico. But we know that experience has taught men that they will live longer in a climate that has well defined seasons, and that they will have more strength and vigor and ambition in a country that has widely varying temperatures. A great deal has been said about the severity of the inclement season upon the dwellers living on the great plains in Iowa, and people in some quarters of the world think it is too near of kin to

an actual polar existence. But even in the midst of the prairies, when the limit of vision is set by the distant snow line along the dull horizon, or by the fury of the blast, shutting you in from the whole world and trying to induce you to sleep, there is something grand and sublime in our real winter. We do not mean here the early winter manifestations that come in the Novembers and stir the blood a little with a cheek color, for winter comes later on that is incomparably finer. We have in mind those February days when the snow is deep and the ice in the ponds underneath it is frozen clear down to the dry earth; when people stir abroad because necessity compels it, and then come back to the cheery fire with hearts and faces aglow and new life and hope in every fiber; of those days when the snow beats about in wild gusts, making the struggle for existence out in it so energetic as to cause us to lose sight of all those lesser vexations that serve to worry one out of the world. Iowa has prairies as broad and billowy as the sea. She has storms that sweep over them in winter that are terrible to face and weird to behold; and she has physical and mental vigor that she could not have without her prairies, her winters or her storms.—*Burlington Post.*

BLUE GRASS AND CLOVER.

"I am a blue grass plant, I am the king of the grasses. I cover the naked earth and tint it with pleasant shades. The cattle on a thousand hills live and thrive upon me. I am good for pasture and good for hay. I make the milk that is turned into butter and clothe the steer with flesh. I fatten the sheep and make its wool grow. The hog likes to seek me under the snow and the colt paws the valley to find me." "Yes," said the red clover, "you do nicely when I feed you, but when you are left to occupy the land alone you make a sorry show. When I am at your back to bring nitrogen out of the clouds for you and keep you going, you grow and spread beautifully. Without me you shrink on the hillside when summer reigns and wither like a broken promise. Take my advice and never go from home without red clover to provide for you. Your relations are with the earth. I have doings with the heavens above us both, therefore, learn that you are dependent on me, as I am on still lower plant forms."—*Prof. James Wilson.*

GROWTH OF IOWA'S COAL INDUSTRY.

BY CHARLES ROLLIN KEYES.

One of the principal lines of investigation taken up during the past season by the Iowa Geological Survey has been in regard to the coal.

In the presentation of the information there are contemplated:

(1) A report somewhat general in its character, perhaps, but something which will supply temporarily a great and ever increasing demand for information pertaining to the coal deposits of the State. This desire for authoritative accounts of the different portions of the great Iowa coal field is shared not only by the citizens of the State but by many persons with means who now reside in distant parts of the Union, but who are desirous of making safe investments in the State, of starting new industries and of becoming, soon, perhaps, residents.

(2) A detailed account of the geological features of the coal districts. This should embrace a full description of the different kinds of beds and their associations, the minute structure of the coal-bearing strata in all its details, the exact relations of the different seams, the distance from the surface that it is necessary to go in order to reach them, the pointing out of notable and easily recognized strata which will act as guides in searching for particular seams of coal, and all kindred information of practical import.

(3) A discussion of practical mining in the State, the methods employed and improvements to be made, the kinds of machinery used and its advantages, the best methods and machinery for prospecting and like information tending toward a greater development of the industry, including utilization of coal dust, slack and the lignites of the Cretaceous strata of northwestern Iowa.

(4) A description of the uses and properties of Iowa coals, together with chemical analyses of all the principal varieties from the different counties, the adaptabilities of the various kinds of steam, for domestic and matallurgical purposes and for gas-making.

The first portion of the work is now completed and the report nearly ready for distribution. It forms a volume like the first annual report of the Survey and is similar to it in size and style. The information obtained in respect to the arrangement of the coal-bearing strata is of the greatest practical value, as well as scientific interest. The leading facts are arranged in the first or general part of the report.

The work is being continued. Special mapping of certain typical areas has been undertaken. Upon these is to be based the construction of several relief models which will show clearly the details of structure, arrangement and present accessibility of the coal seams. These models will exhibit graphically all the facts pertaining to the disposition of the veins, and are adapted to illustrate the nature of coal occurrences over wide areas. A map of the State showing the location of all the mines and the natural outcrops is also contemplated. There will also be indicated the areal distribution of the principal seams of coal.

Extent of the Coal Industry.—The extent and importance of the industrial activities connected with or dependent upon the production of coal is seldom fully appreciated. It is known vaguely, perhaps, that in the State coal is one of the principal mineral resources, but beyond this no adequate conception is held in regard to the part played by it in the State's economy. In the marketing of coal, its mining, storing and transportation, and in the operations necessary to be gone through with in getting the product to the consumer there is employed a much larger amount of capital and a much greater force of laborers than is commonly supposed. Mining alone gives employment to fully 9,500 men, and upwards of $5,000,000 is annually expended at the mines for labor. In the other occupations which have to do with the taking of the output from

the mines and the distribution of it to its final destination, the men employed and the money needed can only be roughly estimated, but it is known to exceed several times that directly connected with mining.

The deposits of mineral fuel in Iowa were brought to the notice of the world through the explorations of Dr. David Dale Owen, who was sent out by the Federal Land Office to survey the mineral lands of the Northwest. His report on the region occupied by Wisconsin, Iowa and Minnesota appeared in the year 1852. In Iowa his most important exploration was made in canoes up the Des Moines river from its mouth to Lizard Fork, near Ft. Dodge. A number of localities were pointed out where good coal could be obtained. A few years later A. H. Worthen went over the same ground and called attention to a number of additional places in which coal was being taken out. Up to this time all fuel mined was for local use.

Growth of the Production.—In 1860 appeared the first attempt to gather definite information regarding the extent of the coal mined in Iowa. According to the figures of the report of the Eighth Census of the United States the valuation of the product for the previous year was $92,180, representing about 48,363 tons. The production by counties was approximately as follows:

COUNTIES.	Tons.	Value.
Appanoose	1,488	$ 2,740
Boone	630	1,200
Davis	577	1,100
Guthrie	289	550
Hardin	262	500
Jasper	2,336	1,450
Jefferson	6,143	11,750
Keokuk	472	900
Lee	315	600
Lucas	945	1,800
Mahaska	3,412	6,500
Marion	1,548	2,950
Monroe	2,756	5,250
Muscatine	1,785	3,400
Polk	1,858	3,540
Van Buren	4,252	8,100
Wapello	17,062	32,500
Warren	2,283	4,350

The State census of 1862 gives a total somewhat less, though work had begun in a dozen counties more than had been reported before. In 1865 the State record shows an output of 69,574 tons, which, the following year, rose to 99,320 tons. In 1868 the output had become still larger, being given for that year as 241,453 tons.

At the United States census of 1870, eighteen of the counties, chiefly small producers, were not enumerated, yet the total production was a considerable increase over the State figures presented two years before—283,467 tons. Coal had by this time assumed an important rank among the resources of the State, the value for this year being over half a million dollars.

The State census of 1875 showed that several new counties had begun to produce coal and an output of 1,231,547 tons, valued at $2,600,140 is reported for that year.

The Tenth Federal Census of 1880 indicated a total tonnage of 1,461,166 for the census year, the product being valued at $2,507,453. This was a total of more than five and one-half times the amount mined a decade previous. By the year 1883 the amount of coal mined had increased to 3,979,946 tons. For four years the annual output remained about the same. In 1888 great activity was developed in the coal industry, the production reaching the grand total of 4,421,822 tons. The two years following showed a slight decrease, the output being given for the former year by the Eleventh Census of the United States as 4,095,502 tons and for the latter year by the State Mine Inspector as 3,980,502. This still farther decreased in 1891, the latter authority giving 3,721,981 tons as an output for that year. Since then the increase has been quite marked.

In 1892 it reached a total of 4,047,479 tons, as given by the Mine Inspectors' report, and in 1893 the returns to the Iowa Geological Survey show a total of 5,043,007 tons. Between the years 1879 and 1889, as shown by the United States Census reports, the advancement of the coal product of the United States was 37 per cent. Iowa in the same period increased her product 279 per cent.

The apparent decrease during the years 1889–1891 was due largely to strikes, and in part, also, to the importation of a considerable quantity of Illinois coal, which, by means of the low rate of transportation obtainable at certain river points, was able to compete successfully with the home product.

During the last two years a large number of new mines have been opened. The development has not been due so much to the discovery of new fields as to closer prospecting and better work in coal territory already opened.

The returns for the last year can not be compared with those of other States, as no results from them are yet published. In 1889, however, as shown by the Eleventh Federal Census, the rank of the different coal-producing States was as follows:

1.	Pennsylvania	81,700,000
2.	Illinois	12,100,000
3.	Ohio	9,900,000
4.	West Virginia	6,200,000
5.	Iowa	5,000,000
6.	Alabama	3,300,000
7.	Maryland	2,900,000
8.	Indiana	2,800,000
9.	Missouri	2,500,000
10.	Colorado	2,300,000
11.	Kansas	2,000,000

From the foregoing it will be noted that as a coal producer Iowa ranks first among the States west of the Mississippi river and fifth among the States of the Union.

Number of Mines and Value of Product.—The coal mine operators employing ten men and upwards are nearly four hundred in number. Small owners having less than ten employes probably would increase the total number of separate organizations engaged in mining coal to something over five hundred.

A large majority of the mines have only a small output. Some, however, have a capacity of 1,000 tons daily and a few have even a larger capacity. The companies having the largest output usually prefer to work several mines of smaller capacity rather than to concentrate the work in one plant. The total output of 1893 was over five

millions and shows a very considerable increase over that of former years. The value of this amount of coal may be safely estimated at nearly eight million dollars.

Chief Localities.—The most productive coal region of Iowa is a broad belt running approximately along the Des Moines river from the southeastern corner of the State to Ft. Dodge, in Webster county. In 1893 twenty-four counties produced coal in commercial quantities. Arranged in the order of their rank they are as follows:

1.	Mahaska	1,093,530
2.	Polk	693,103
3.	Appanoose	650,775
4.	Monroe	648,300
5.	Marion	329,160
6.	Jasper	293,400
7.	Wapello	284,660
8.	Keokuk	270,350
9.	Boone	267,310
10.	Webster	249,100
11.	Wayne	47,121
12.	Taylor	35,570
13.	Dallas	33,800
14.	Van Buren	26,300
15.	Greene	25,200
16.	Adams	20,085
17.	Guthrie	19,080
18.	Scott	16,500
19.	Warren	14,725
20.	Lucas	12,330
21.	Jefferson	7,140
22.	Davis	2,620
23.	Adair	1,840
24.	Page	1,800

These figures, arranged geographically into the districts which are fully described elsewhere, indicate at the same time the relative productiveness of the different sections of the State.

North-Central Iowa, comprising the counties of Humboldt, Webster, Hamilton, Hardin, Greene, Boone, Story and Marshall, 541,610 tons.

Central Iowa, including the counties of Guthrie, Dallas Polk, Jasper, Poweshiek, Madison, Warren, Marion and Mahaska, 2,476,806 tons.

Southeastern Iowa counties of Keokuk, Lucas, Monroe, Wapello, Jefferson, Henry, Wayne, Appanoose, Davis and Van Buren, 1,949,596 tons.

Southwestern Iowa, Shelby, Audubon, Pottawattamie, Cass, Adair, Mills, Montgomery, Adams, Union, Clarke, Fremont, Page, Taylor, Ringgold and Decatur counties, 59,295 tons.

Eastern Iowa (counties containing outliers), Iowa, Johnson, Scott, Muscatine, Washington, Louisa, Des Moines and Lee, 16,500 tons.

A comparison of the output of the various counties shows that Central Iowa is the most productive portion of the field. Next to it is Southeastern and after that North-Central Iowa. A review of the output in past years shows that there has been a movement of the industry from the northern to the southern counties as well as a corresponding movement west from the Mississippi. At present the main industry is concentrated in the Des Moines valley. The considerable difference between the productiveness of the Lower and Upper Coal Measures is also shown in the same table.

Present Territory Supplied—By far the larger proportion of the coal mined in Iowa finds its market within the State, a considerable portion not leaving the county within which it is mined. In 1889 the production of coal in the State was 4,095,358 tons, while the consumption was nearly 3,411,044 tons, leaving a balance of 648,314 tons to be marketed elsewhere, or about 16 per cent of the total product. Applying this same percentage to the output in 1893 and we get a total of 806,881 tons sent out of the State. It seems probable however, that the per cent exported may now be somewhat greater, though there is not sufficient data at hand to give the exact increase. This brings into the State annually between one and two million dollars and aids quite materially in building up the various industries directly or indirectly depending upon coal mining.

The greater portion of the coal exported is sent north and west; to Kansas, Nebraska, South Dakota and Minnesota; a small amount is sent to Missouri and occasionally some to Illinois. During the past summer the trade with Kansas has been particularly brisk owing to the strike in the coal region of that State. Probably Nebraska usually takes more of the Iowa coal than any other State. The competition met here is principally that of Illinois, though the Kansas and Missouri mines supply part of the trade. Farther north in South Dakota and Minnesota eastern coal comes into competition, especially for domestic use; the greater heating power and cleaner character of the Pennsylvanian anthracite being considered to counterbalance its greater cost.

Wherever, however, a cheap coal is desired the Iowa coal operators are usually able to command a fair share of the trade. It seems reasonable to expect a continued steady growth of the export trade and considerable enlargement of the market as new territory is opened up and better shipping facilities are provided.

DAIRY STATISTICS.

Butter statistics are surprising. The census return showed the enormous aggregate of 600,000 tons, or 1,200,000 pounds, manufactured in the United States in 1899; and the quantity has probably increased since, says the *Produce Journal*. How much of this was oleomargarine, sold under the name of butter, it is now getting a little late in the day to enquire. But the returns are professedly all of genuine butter and this may be the fact. It is said that the 1890 product in this country would require 1,000 freight trains of thirty cars each, and each car carrying twenty tons, to transport it. Iowa seems to be the largest butter producer—her return three years ago being 100,000,000 pounds, worth $21,000,000. Illinois stood next with 95 000.000, worth $20,000,000. Wisconsin's product was 45,000,000, worth $9,000,000, and Minnesota's nearly as great—hers being worth $8,000,000, while Michigan's was worth $7,500,000. In 1885 the assessed value of the cows was $700,000,000, more than the capital of all the national banks at that time. Incredible as it may seem, it appears that the annual dairy butter product in the United States exceeds in value that of all the lumber, wheat and iron combined. That, at any rate, is the statement of a statistician who publishes the results of his figuring. Other dairy statistics, milk, cream and cheese, also make a big showing.—*Farm and Dairy.*

METEROLOGICAL REVIEW FOR 1893.

BY OBSERVER LUKE ROBERTS, M. D., OF CLINTON, IOWA.

Compared with the fourteen preceding years, the year 1893 shows a mean daily temperature of .2° below normal. Of the fifteen years five have given a mean temperature below that of 1893, viz:—1883, 1884, 1885, 1886, 1888; the year 1881 was the same as 1893, and the rest of the fifteen years the yearly means were above. The lowest yearly mean in the fifteen years was in 1885, when it was only 43.9°. The highest yearly mean for the period mentioned was 48.6°, in 1890; so that the extreme range was 4 7°, for the fifteen years.

. January, 1893, was one of the coldest Januaries.

Since 1839, that of 1883 was a record breaker in severity, but in its monthly mean only went .3° below that of 1893. The first month of 1893 was continuously cold throughout, the highest temperature reaching 39°; this was on the 24th. The temperature was below zero on twenty different days during the month, ten of these being consecutive, from the 10th to the 19th inclusive. The customary January thaw did not put in an appearance. The ground was contiouously covered with snow, and fine sleighing prevailed during the entire month. On the 28th a steady misty rain continued all day, forming a crust on the snow, and ice on trees and shrubbery. Walking became difficult and dangerous. The balance sheet of January showed a large reserve of frigidity which was carried over into February, and only exhausted after a ten days' run. The temperature for this month was phenomenally unstable, going high and low on alternate days, the cold predominating, and at its close we find the mean temperature to have been 4.9° below normal. The precipitation for the month was about normal and largely snow which continued the good sleighing through the entire month.

Let us now review the three winter months just closed and compare with like seasons for the last fourteen years. The depth of snowfall was 27 inches—11.5 inches above a normal of the last fourteen winters. But two winters in the time given furnished more snow. Good sleighing prevailed during the winter just closed, without a day's interruption. This was not wholly due to the amount of snow, but rendered possible by the continuous cold and the snow fall occurring at frequent intervals. Continuous sleighing for so great a number of days is without a parallel in eastern Iowa, so far as I have information. Roads were exceptionally good during this season and business was much benefited. The mean temperature for this season was 14 5°. But one winter season of the last fourteen years gave a lower mean temperature, viz: 1884-85, 12 2°.

March furnished no special phenomena. The temperature was slightly above normal and also the precipitation. The movement of the wind was below normal. The mildness of this month encouraged us to look for an early spring, but we looked in vain.

April was of seasonable warmth and fairness for the first fourteen days and furnished favorable conditions for seeding and preparation of the soil for planting, and farmers utilized every day to the best advantage. The rest of the month was almost wholly cloudy with frequent showers and chilly temperature. Field work was greatly retarded and vegetable growth almost at a stand. Fruit trees were belated, grass of slow growth and horticultural pursuits embarrassed. The impediments to farm work and growth of vegetables was not so much due to the amount of precipitation as to its constant drizzle, lack of sunshine and low temperature. The last day of the month was colder than the first. The first decade gave a mean temperature of 53.3°; second decade, 45.3°; and the third decade, 41.4°. During the last fifteen years there were but two Aprils colder, viz., 1879 and 1881.

Precipitation was greatly in excess. But one other April in the last fifteen years that furnished more. The cold weather of April continued through the first seven days of May. The rest of the month was not open to criticism. The meteorological conditions that prevailed through the month compare favorably with the average May. Farm work was prosecuted vigorously, and a generous harvest seemed now assured.

June furnished no meteorological excesses. The growth of agricultural and horticultural products were favored with proper conditions, which were highly appreciated by those interested in these pursuits, as the season was some days late on the first of the month. Corn, oats, potatoes, meadow grass and pastures, as well as small fruits, flourished almost without a precedent, so that at the close of the month they were found up to an average in their race toward maturity.

July was deficient in rain. All other conditions were favorable to growth and maturity of crops. It was a very warm month with an excess of sunshine. The uniformity of temperature and absence of sultry, breathless nights is worthy of special mention. On the 13th a wind storm did some damage. From that date to the close of the month, no rain fell, but nature was kind in depositing copious dew nearly every night, which did much to keep the soil freshened. The need of rain was much felt before the close of the month, and during the last ten days much anxiety prevailed over the prospects of a disastrous drouth. Even an immediate rain could not save pastures, corn and potatoes from severe shrinkage.

August was also deficit in rainfall. The first precipitation was on the 10th, the next and only other storm occurred on the 25th. Total precipitation from the two storms only 1.20 inches. The temperature of the air was about normal, and gave warm days and cool nights. While the per cent of cloudiness was very low, the atmosphere was somewhat hazy a large portion of the month. On the 6th a fine auroral display, commencing at 9 o'clock P. M., continued all night till broad daylight, when it vanished from the overpowering rays of the morning sun. It was of the streamer type, alternating from quite faint to very bright. Between 11 and 12 P. M., and again between 2 and 3 A. M. of the 7th, it was specially interesting as the bright and numerous streamers shot well up towards the zenith. The month closed with dry fields and dusty roads. Pastures were dry and feeding of stock became a necessity. Corn had nearly matured and in this county promised a very good crop.

The advent of September was heralded by a brilliant

meteor on the evening of the first day. No rain fell during the first eighteen days,and a severe and wide-spread drouth was doing its withering work by prematurely ripening corn, stopping the growth of potatoes and rendered pastures useless, and stock could only be kept thriving by cutting the withered corn and feeding it to them. A modest shower on the 18th slightly checked the drouth, and on the 21st a copious rain scattered the gloom that had possessed the people, and gladness and joy once more prevailed. The 22d and 24th furnished some rain and on the 29th and 30th a bountiful precipitation brought the monthly rainfall up to 4.25 inches, 1.21 above normal. The first frost of the season was visible on the morning of the 25th, and was light. The next morning there was a freeze. At the time of the storm on the 18th the water in the Mississippi river was within a few inches of low water mark. The month closed with the drouth thoroughly quenched, and plowing was resumed with avidity by farmers.

October was a fine month, but deficient in rainfall. The mean temperature was above normal and also the number of clear days. For the ingathering of crops and the prosecution of all outdoor work conditions were highly satisfactory. The 14th was a notable day for wind, but no local damage resulted. A wide-spread and damaging storm prevailed along the lakes and the coast from Florida to New York.

November furnished a small per cent of cloudiness, much sunshine and a limited amount of rain. On the 30th snow commenced falling and continued until 2 P. M., leaving a deposit four inches deep, which made excellent sleighing, and was made use of liberally as evidenced by the jingle of sleigh bells all through the afternoon and evening, proving a happy sequel to Thanksgiving festivities.

There were no marked conditions to bring December into more prominent notice than December generally furnishes. The first decade was cold, but the balance of the month was moderate. Physical comforts prevailed during this period, which, with the hard times and high price of fuel, was a great boon to the poor people.

The most influential elements of the weather, both on man and vegetation are the temperature, cloudiness, rainfall and wind. During the last twelve months these elements have gone to some extremes, but as a whole, we find at the close of the year that a happy medium has been the normal condition. As a result the year has been satisfactorily prolific in food products, and the general health of the inhabitants of Iowa. This was manifest by the unusual interest taken in the observance of Thanksgiving, with the many kind and practical remembrances of the needy.

CONSPECTUS.

Highest temperature, 96°, August 10th.
Lowest temperature, 20° below zero, January 17th.
Extreme range of temperature, 113°.
Mean daily temperature, 46.2°.
Mean daily range of temperature, 24.6°.
Greatest mean monthly range, 33.1°, November.
Least mean monthly range, 19.9°, March.
Greatest daily range, 44°, April 2d, September 17th.
Least daily range, 5°, March 22d, November 27th.
Warmest month, July—mean temperature, 76°.
Coldest month, January—mean temperature, 8.1°.
Warmest day, July 7th—84.2°.
Coldest day, February 7th—10° below zero.

Total number of days with maximum temperature 90° or above, 25—2 in June, 16 in July and 7 in August.

Total number of days with maximum temperature below 32°, 62—28 in June, 15 in February, 5 in March, 4 in November, and 10 in December.

Total number of days with the minimum temperature 31°, 149—31 in January, 28 in February, 23 in March, 8 in April, 1 in May, 1 in September, 7 in October, 23 in November, 27 in December.

Total number of days with the mean temperature below 32°, 108—31 in January, 27 in February, 14 in March, 2 in October, 11 in November, 23 in December.

THE SKY.

Mean daily cloudiness, 42 per cent of surface of sky.
Month with greatest per cent of cloudiness, March—69.
Month with least per cent of cloudiness, August—20.
Total number of clear days, 138.
Total number of cloudy days, 84.
Month with greatest number of clear days, July—18.
Months with least number of clear days, January and December—6 each.
Month with greatest number of cloudy days, April—16
Months with least number of cloudy days, July and August—1 day each.

PRECIPITATION.

Total depth of snow fall, 43 inches.
Greatest fall of snow at any one storm, 5 inches—January 11th and February 5th.
Total precipitation, rain (and snow melted) 30 39 inches.
Greatest rainfall at any one storm, 2.08—April 11th.
Month with greatest precipitation, April—5.48 inches.
Month with least precipitation, October—.68 inches.
Month with greatest number of stormy days, April—13.
Month with least number of stormy days, August—2.
Total number of stormy days, 93.

THE WIND.

Total movement of wind, 51,600 miles.
Maximum velocity per hour, 40 miles—December 18.
Greatest monthly movement, 6,760 miles—April.
Least monthly movement, 2,080 miles—August.
Prevailing direction, west.

Observations taken at 7 A. M., noon, 2 P. M., and 9 P. M., show the movement of the wind to have been from the north 76 times; from the northeast 131 times; from the east 105 times; from the southeast, 115 times; from the south, 119 times; from the southwest, 151 times; from the west, 214 times; and from the northwest, 177 times.

Maximum velocity for January, 27 miles an hour; for February, 25 miles; for March, 26 miles; for April, 32 miles; for May, 23 miles; for June, 32 miles; for July 36 miles; for August, 20 miles; for September, 20 miles; for October, 26 miles; for November, 26 miles; for December, 40 miles.

SNOW AND FROST.

The last spring snow fell on the 21st of April—only ½ inch.

The first snow in autumn fell on the 21st of November—2 inches.

Last killing frost in the spring—April 17th.

Last frost May 3d and 4th.

First killing frost in autumn, September 26th; a light frost on the 25th.

Number of consecutive days without killing frost 162, the same as in 1892.

The temperature of the air was at the freezing point or below for the last time in the spring on the 6th of May.

The first in Autumn—September 27th.

The last day when the mean daily temperature of the air was below 32° was March 26th.

The first in autumn—October 28th.

ELECTRO METEORS.

Number of auroras observed—6.

Number of days with thunder and lightning—17.

It is notable that there was a minimum amount of thunder and lightning during the year, and none seriously damaging.

An unusual limited number of solar and lunar halos observed, as also meteors.

Following is a table showing the yearly mean temperature, rainfall and movement of the wind for the years named:

YEARS.	Mean Temp. degrees.	Rainfall in inches.	Wind movement—miles.
1879	46.7	34.18	.....
1880	47.1	36.18	.....
1881	46.2	41.17	.....
1882	47.3	41.18	61,460
1883	44.0	38.71	63,560
1884	45.7	43.40	54,440
1885	43 9	38.21	54.490
1886	45.6	28.71	49.260
1887	47.2	34.01	53,110
1888	45.1	35 80	56,295
1889	48.1	31.98	49,720
1890	48 6	32.62	51,890
1891	48.5	33.87	48,625
1892	46.4	40.73	43,890
1893	46.2	30.39	51,600
Means	46.4	36.07	53,195

DEATHS BY VIOLENT WINDS AND LIGHTNING.

The following tables are copied from the annual report of the Chief of the Weather Bureau, 1891-1892, which was recently issued and shows the distribution of deaths in the United States caused from wind or lightning.

Table No. 1 shows the number of deaths by wind during each month of the years 1890-1892. Comparing this table with No. 3, it will be seen that deaths by wind are distributed much more uniformly through the months than those by lightning; the latter increase very raipdly from 2 in March to 216 in June, and 212 in July. This shows that lightning strokes are more prevalent than violent winds during the hotter months. It will be seen that contrary to the common idea, deaths by lightning outnumber those by violent wind. If we omit the 141 deaths by the tornado of March 27, 1890 (the Louisville tornado), we shall find that only 40 per cent of the deaths from these two causes were produced by high wind. Seventy to eighty per cent of the deaths by lightning are due to persons standing under trees or unduly exposing themselves.

DEATHS BY WIND, MONTHS AND YEARS.

YEAR.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1890	....	....	160	6	26	27	29	25	....	....	....	....	273
1891	2	1	10	9	9	35	30	11	1	....	....	....	108
1892	....	....	....	20	38	60	34	31	7	....	....	....	190
Total	2	1	190	53	96	96	90	43	1	....	....	....	571

DISTRIBUTION OF DEATHS FROM WIND BY STATES.

STATES.	1890.	1891.	1892.	Total.	STATES.	1890.	1891.	1892.	Total.
Alabama	....	....	....	....	Montana	....	1	1	2
Arkansas	....	3	3	6	Nebraska	7	3	6	16
California	....	....	....	....	Nevada	....	....	....	....
Colorado	....	2	....	2	New Hampshire	....	....	....	....
Connecticut	....	....	....	....	New Jersey	....	....	2	2
Delaware	....	....	....	....	New Mexico	....	....	....	....
Dist. of Columbia	....	....	....	....	New York	....	4	2	6
Florida	....	....	....	....	North Carolina	....	1	....	1
Georgia	....	....	....	....	North Dakota	12	....	....	12
Illinois	27	8	17	52	Ohio	2	5	9	16
Indiana	1	3	6	10	Oklahoma	....	....	4	4
Indian Territory	....	....	....	....	Pennsylvania	28	8	2	38
Iowa	3	3	3	9	South Carolina	1	....	....	1
Kansas	3	1	65	69	South Dakota	1	3	7	11
Kentucky	141	11	1	153	Tennessee	5	....	....	5
Louisana	....	18	....	18	Texas	17	5	17	39
Maryland	....	....	....	....	Virginia	4	1	2	7
Maine	1	1	2	4	Vermont	....	....	....	....
Massachusetts	8	....	....	8	West Virginia	....	....	2	2
Michigan	....	1	....	1	Wisconsin	....	8	3	11
Minnesota	7	....	27	34	Wyoming	....	....	....	....
Mississippi	....	13	....	13					
Missouri	5	5	9	19	Total	273	108	190	571

DEATHS CAUSED BY LIGHTNING DURING THREE YEARS ACCORDING TO THE WEATHER BUREAU RECORDS.

MONTH.	1890	1891	1892	MONTH.	1890	1891	1892
January	....	....	....	September	....	8	2
February	....	....	....	October	....	....	....
March	2	....	....	November	....	....	....
April	6	13	5	December	....	....	....
May	8	23	26				
June	37	77	102	Year	120	236	292
July	55	62	95				
August	12	53	62	Total			648

NATIONAL CROP REPORT.

WASHINGTON, Jan. 8.—The estimates of the area and product of principal cereal crops, potatoes, tobacco and hay for the year 1893, as completed by the statistician of the department of agriculture, make the aggregate corn area 72,036,463 acres; product, 1,619,496,131 bushels. Wheat area, 34,629,418 acres; product, 396,131,750 bushels. Oats, 27,273,933 acres; product, 638,854,850 bushels. Rye, acres, 2,037,485; product, 26,555 446 bushels. Barley, acres, 3,220,371; product, 69 869,495 bushels. Buckwheat, acres, 815,614; product, 12,132,311 bushels. Potatoes, acres, 2,605,186; product, 183,034,203 bushels. Tobacco, 702,952 acres; product, 483,023,963 pounds. Hay, 49,613,469 acres; product, 65,766,158 tons.

The average yield of corn per acre is 22.5 bushels; wheat, 11.4 bushels; oats, 23 4 bushels; rye, 13 bushels; barley, 21.7 bushels; buckwheat, 14.9 bushels; potatoes, 72.2 bushels; tobacco, 68.7 pounds; hay, 1 33-100 tons. The returns of the correspondents of the department make the acreage of winter wheat lower than last fall, 92.2 per cent of the area harvested in 1893.

DECEMBER WEATHER REPORT

The daily mean temperature for December was 22°, which was about 1.5° below the normal for the State. The first half of the month was unusually cold, and the last half warmer than the average of December weather,

At the central station precipitation fell on 22 days of the month. The average amount for the State, 1.31 inches, was about 0.34 below the normal. During a considerable portion of the month the larger part of the State was covered with snow of sufficient depth to make good sleighing. At the close of the month the ground was generally bare.

The following table gi es, as a basis of comparison, the mean temperature and total precipitation at the stations named for the years from 1872 to 1893 inclusive:

YEARS.	MEAN TEMPERATURE, DEGREES.						PRECIPITATION, INCHES.					
	Des Moines.	Davenport.	Dubuque.	Keokuk.	Omaha.	Sioux City.	Des Moines.	Davenport.	Dubuque.	Keokuk.	Omaha.	Sioux City.
1872	....	18	....	18	18	....	.....	0.61	.....	0.50	0.12	.....
1873	....	30	27	32	25	....	.....	3.84	2.07	8.56	0.93	.....
1874	....	28	30	31	28	....	.....	0.50	0.65	1.26	0.54	.....
1875	....	34	34	35	34	....	.....	3.08	2.71	3.93	1.00	.....
1876	....	15	14	19	19	....	.....	6.36	0.52	0.23	0.16	.....
1877	....	42	40	45	39	....	....	2.32	2.70	2.90	2.14	.....
1878	20	20	20	22	22	....	1.15	0.97	1.12	1.95	0.27	.....
1879	21	24	20	27	17	....	1.39	1.02	1.28	1.45	1.75	....
1880	20	22	19	25	18	....	0.81	1.15	1.25	0.67	0 28	.....
1881	35	38	35	38	36	....	0.85	1.71	1.55	1.70	1.56	.....
1882	24	28	23	28	25	....	2.50	1.78	1.79	1.75	0.92	....
1883	27	31	27	32	29	....	1.08	0.99	1.88	1.20	0.73	....
1884	18	25	21	24	17	....	1.93	3.68	4.08	3.91	0.72	.....
1885	28	26	25	28	29	....	1.91	1.95	3.14	1.96	1.17	.....
1886	19	18	16	22	18	....	0.81	0.53	1.03	1.03	1.46	.....
1887	23	24	23	28	24	....	1.42	3.26	3.07	2.93	1.11	.....
1888	29	30	29	34	30	....	2.44	2.59	1.96	1.61	0.96	.....
1889	40	40	37	43	39	35	0.57	1.60	1.38	1.08	0.50	1.14
1890	32	30	27	34	35	32	0.11	0.62	0.82	0.03	0.08	0.10
1891	35	35	33	33	35	31	1.54	1.64	2.08	1.33	2.07	2.48
1892	20	20	18	26	22	21	1.95	2.73	2.08	1.50	1.79	0.20
1893	23	24	22	29	27	20	1.30	1.67	1.35	0.90	1.13	1.57
Means	26	28	26	30	26	28	1.37	1.77	1.86	2.10	0 97	1 1$_0$

SUMMARY OF WEATHER CONDITIONS.

Barometer—Mean pressure for the month 30.14 inches. Highest observed 30 88 inches, at Dubuque on the 13th. Lowest observed 29.53 inches, at Des Moines on the 15th. Range for the month 1.35 inches.

Temperature—Monthly mean 22.0; highest monthly mean 29.4 at Centerville. Lowest monthly mean 15 4 at Cresco. The highest temperature reported was 70 at Centerville on the 2d. The lowest temperature reported was 21 below zero at Sibley on the 1st. Average daily maximum, 32.2; average daily minimum 12.2; average monthly maximum, 55.2; average monthly minimum, 9.5 below zero; greatest monthly local range, 77 at Centerville; least monthly local range, 56 at Storm Lake; range for the entire State, 19; average for the entire State, 68 4.

Precipitation—Average for the State, as determined from 69 voluntary observers' reports, 1.31 inches. The greatest amount reported, 2.80 inches at Centerville. The least amount reported, 0.46 inches at Villisca. Average number of days on which .01 or more inches of precipitation fell, 7; number of cloudy days, 12; partly cloudy days, 9; cloudless days, 10.

Hail—Greenfield, 24th; Indianola, 7th; Ovid, 24th; Galva, 24th.

Thunderstorm—Overspread the State quite generally the evening of the 24th; seemingly moved in from the southwest, and reached the northeast part of the State in about two hours.

Foggy Days—Greenfield, 15th and 23d; Panama, 24th and 25th; Larrabee, 8th and 11th; Hampton, 8th, 14th, 23d; Centerville, 15th, 23d.

Blizzard—Greenfield, afternoon of 15th; Des Moines, afternoon of 15th.

Sleet—Rock Rapids, 12th, 24th.

Solar Halo—Hopevilie, 4th; Amana, 1st; Mechanicsville, 17th.

Lunar Halo—Amana, 21st; Ames, 19th; Ft. Madison, 27th.

Parhelia—Ames, 29th.

ATMOSPHERIC PRESSURE.

STATIONS.	Mean reduced barometer.	EXTREMES.			
		Highest barometer	Date.	Lowest barometer	Date.
Cedar Rapids	30.10	30.85	13	29.59	15
Clarinda	30.16	30.81	12	29.62	15
Cresco	.....	30.87	12	29.64	18
Davenport	30.13	30.85	13	29.60	28
Des Moines	30.15	30.82	13	29.53	15
Dubuque	30.11	30.88	13	29.55	18
Keokuk	30.14	30.81	13	29.63	15
Omaha (Neb)	30.16	30.83	12	29.69	15
Sioux City	30.14	30.82	12	29.74	24
Means	30.14	30.88	13	29.53	15

WIND MOVEMENT.

STATIONS.	Miles.	Maximum velocity.	Direction.	Date.
Davenport	8,399	52	SW	18
Des Moines	6,198	30	NW	25
Dubuque	4,517	30	NW	18
Keokuk	7,142	38	NW	18
La Crosse (Wis)	5,602	42	W	18
Omaha (Neb)	5,945	24	W	18
Sioux City	7,589	38	NW	15

OBSERVERS' NOTES.

Carroll (Carroll county).—MOSES SIMON. Winter wheat was well protected from the 2nd to the 20th inst.

Belle Plaine—W. W. VANDIKE. The ground was well covered with snow until the 22nd. A few drifts only left

Cedar Rapids.—H. D. OLDS. Snow all gone on open ground and but little remaining in the timber. The mean temperature for month of December since 1884 is 26 6. The warmest that of 1889 being 38.4°. The coldest 1886 with a mean of 16.5. Precipitation about normal.

College Springs. A. A. BERRY. Last half of month very mild. Ground very dry. Fall wheat doing well. Not much frost in the ground. Not much hay fed yet. A light thunder storm on 24th.

Hopeville.—MILTON T. ASHLEY. Bright rainbow on the 24th; remarkable for duration; was generally noticed and spoken of by many. Mean temperature for that day, 53.5°. Very little frost in ground.

Williams.—MERTON L. FULLER. Rain from a cloudless sky. A light shower accompanied a change of wind from southwest to northwest at 9 P. M. of the 4th. The rain drops varied much in size, many being quite large. No clouds were visible to the windward of station nor in the central sky—only a thin veil of haze through which the stars were plainly visible. Similar conditions, though less marked, prevailed at the commencement of storm on the 8th. Ground has been bare since the 22nd, and weather bad for winter wheat.

Hopkinton—THEO. MARKS. On Jan. 1, 1844, the morning was rainy, with S E wind. Jan. 1st, 1854, fair, N W wind; temperature in morning, —5°; 2 P. M., zero; 9 P. M., zero. Jan. 1, 1864, fair, N W wind; morning temperature, —28°; 2 P. M., —18°; 9 P. M., —23°. Jan. 1, 1874, clear, S wind, temperature, 30° in morning, 47° at 2 P. M. and 40° at 9 P. M. Jan. 1, 1884, cloudy, N E wind; temperature, 17°, 17° and 15°; snow, 2 inches. Jan. 1, 1894, fair, S W wind; temperature, 28°, 47° and 44°.

DELAYED REPORTS.

Atlantic (September)—Mean temperature, 66.2°; mean maximum, 86.3°; mean minimum, 46.2°; highest observed, 100°, on the 9th; lowest observed, 24°, on the 26th. Total rainfall, 2.58 inches. Number of clear days, 28; part cloudy, 2; cloudy, 0; rainy, 3; prevailing wind, south.

Fayette (September)—Mean temperature, 67 7°; maximum, 100°, on the 7th; minimum, 37°, on the 2d; total rainfall, 1.97 inches; prevailing wind, southeast; light frost on the 2d.

Fayette (November)—Mean temperature, 32.5°; mean maximum, 44 0°; mean minimum, 21.0°; highest observed, 73°, on the 1st; lowest observed, 9° below zero, on the 30th; total precipitation, 1.40 inches; total snow during the month, 6.0 inches; on ground at end of month, 6.0 inches; prevailing wind, northwest; number of clear days, 13; part cloudy, 10; cloudy, 7; rainy, 7.

Atlantic (October, 1893)—Mean temperature, 52.9°; mean maximum, 69 0°; mean minimum, 36.8°; highest observed, 96°, on the 8th; lowest observed, 21°, on the 30th. Range for the State, 75°. Total precipitation, .36 inches. Number of clear days, 25; partly cloudy, 2; cloudy, 4; rainy, 2.

Mt. Ayr (September, 1893).—Mean temperature, 71.3° (25 days); maximum, 98°, on the 5th, 6th, 8th, 9th and 13th; minimum, 47° on the 24th.. Total rainfall, 1.49 inches.

Mt. Ayr (February, 1893).—Mean temperature, 20.9°; highest, 48°, on the 19th; lowest, 15° below zero on the 1st. Maximum, 32.4; mean minimum, 9 1. Total rainfall, .95 inch. Total snowfall, 4 inches. Rainy days, 6. Prevailing wind, southwest. Cloudy days, 22. Clear days, 6.

METEOROLOGICAL DATA FOR DECEMBER, 1893.

STATIONS.	TEMPERATURE OF THE AIR (IN DEGREES FAHRENHEIT).								PRECIPITATION IN INCHES.			Prevailing direction of wind.	Killing frost.	No. of cloudless days.	No. of partly cloudy days.	No. of cloudy days.	No. of rainy days. (.01 inch or more).	No. of hail-storms.	No. of thunder-storms.
	Monthly mean.	EXTREMES. Mean maximum.	Mean minimum.	Maximum.	Date.	Minimum.	Date.	Monthly range.	Monthly.	Total snowfall.	Depth of unmelted snow at end of month.								
Algona	17.7	....	....	44	23	-14	1	58	1.60	5.0	T	NW	....	4	20	7	6	..	1
Ames (J. J. Eggerton)	16.5	29.0	3.9	56	24	-12	1	68	1.28	..	.....	NW	....	7	6	18	8	..	..
Ames (W. H. Hellman)	....	....	....	....	....	....	....	....	1.35	..	.....	....	....	....	....	....	8	..	..
Ames (4 miles sw of)	22.5	....	....	56	24	- 8	1	64	1.05	8.6	.....	NW	....	....	....	....	9	..	..
Amana	21.4	30.1	12.6	57	24	-10	1	67	1.22	5.0	.....	NW	....	10	10	11	7	..	..
Atlantic	21.7	34.4	9.0	55	23	-10	1	65	1.95	9.0	T	NW	....	10	6	15	6	..	..
Audubon	22.2	33 0	11.3	56	24	-10	1	66	1.55	8.0	.....	NW	....	4	7	20	4	..	..
Belle Plaine	20.2	29.5	10.9	55	24	-10	1	65	1.17	9.5	T	W & S	....	4	6	21	7	..	1
Bonaparte	25.7	36.4	14.8	63	24	- 8	4	71	1.17	7.0	.....	....	....	....	....	....	5	..	..
Carroll	18.7	29 0	8.4	56	23	-10	1	57	1.37	12 5	.....	....	....	9	13	9	8	..	1
Cedar Rapids	22.9	30.5	15.4	58	24	- 7	13	65	2 40	15.4	T	NW	....	13	5	13	10	..	1
Centerville	20.4	46.8	11.9	70	23	- 7	12	77	2.80	7.5	.....	NW	....	19	7	5	4	..	..
Charles City	16.3	23.8	8.9	50	23	-16	1-12	66	1.76	3.5	.....	NW	....	....	....	....	7	..	1
Clarinda	25.4	34 9	15.9	57	24	- 3	1	60	0.76	6.5	.....	S	....	15	7	9	5	..	..
College Springs	26.5	36.9	16.3	59	24	- 4	1	63	.90	7.0	.....	S	....	12	9	10	....	..	1
Corning	26.3	37.4	15.1	59	24	- 5	1	64	.82	3 5	.....	NW	....	15	5	11	5	..	..
Cresco	15.4	23.5	7.3	48	24	-17	1	65	1.17	3.5	.....	NW	....	4	11	16	8	..	..
Davenport	21.0	31.8	16.8	59	24	- 8	1	67	1.67	...	.....	W	....	4	13	14	15	..	1
Decorah	19.2	27.3	11.2	53	24	-13	12	66	1.73	5.2	.....	....	....	10	4	17	11	..	..
Delaware	18.8	....	....	52	24	-10	1	62	1.44	5.3	.....	NW	....	8	7	16	11	..	1
Denison	20.6	30.7	10.5	55	24	- 5	12	60	0.60	6.0	.....	W	....	10	9	12	5	..	..
Des Moines	23.0	31.8	17.7	59	24	- 8	1	67	1.30	11.5	T	NW	....	9	9	13	12	..	1
Dubuque	22.0	29.5	14.7	58	24	-11	13	69	1.33	....	.....	NW	....	9	7	15	12	..	..
Elkader	19 0	27.9	10 0	53	24	-17	13	70	1.85	6.0	.....	NW	....	12	7	12	11	..	1
Ft. Madison	29.0	....	....	60	24	- 2	6	62	1.51	8.5	.....	SW	....	7	8	16	16	..	5
Galva	18.3	29.5	7.1	48	24	-11	1	59	1.54	7.3	.....	NW	....	6	15	10	7	1	1
Glenwood	28.5	40.3	16 8	64	22	0	12	64	0 47	4 8	.....	SW	....	12	11	8	3	..	..
Grand Meadow	20.0	....	....	51	24	-13	1	64	1.86	6 0	.....	NW	....	8	10	13	9	..	..
Greenfield	23.3	34.5	12.0	60	24	-10	1	70	1 86	15.4	.....	NW	....	7	6	18	11	..	..
Grinnell	22.2	30.7	13.6	54	25	-10	1	64	2.62	8.0	.....	NW	....	8	11	12	8	..	..
Grundy Center	19.0	29.3	8.6	53	24	-11	12	64	.98	3.8	T	NW	....	10	10	11	11	..	1
Hampton	16.7	25.2	8.2	51	24	-13	1	64	1.38	3.6	.....	NW	....	5	21	5	11	..	..
Hopeville	25.2	35.3	15.0	58	24	- 5	1	63	0 53	3.6	.....	NW	....	6	17	8	6	..	..
Hopkinton	23.3	....	....	52	24	- 5	15	57	2.20	8.0	.....	NW	....	....	....	....	7	..	..
Humboldt	....	....	....	....	....	....	....	....	1 02	....	.....	S & SE	....	14	11	6	4	..	..
Indianola	23.3	35.2	11.2	59	25	-12	30	71	1.10	7.4	.....	NW	....	12	5	14	7	..	..
Iowa City	25.3	36 5	14.1	60	25	- 9	1	69	1.52	11.8	.....	NW	....	5	9	17	6	..	..
Iowa Falls	16.7	26.8	6.7	50	24	-14	1	64	1 50	...	.....	NW	....	9	5	15	6	..	..
Jefferson	21.7	34.4	8.9	55	26	-10	1	65	0.60	8.0	.....	S	....	17	....	14	....	..	..
Keokuk	29.0	37.6	20.5	66	23	- 6	1	72	0 90	7.8	.....	NW	..	8	13	10	10	..	..
Keosauqua	27.1	37.1	17.0	61	24	- 5	4	66	0.80	10.5	.....	....	....	....	....	....	7	..	1
Larrabee	17.4	28.4	6.4	48	24	-14	1	62	2 27	5.8	1.0	....	....	4	15	12	8	1	1
Maquoketa	23.6	....	....	....	....	....	....	....	1.10	4.5	.....	....	....	....	....	....	7	..	..
Mechanicsville	21.0	29.0	13.5	56	24	-10	1, 3	66	0.73	7.2	.....	W	....	8	6	17	9	..	1
Monticello	19.9	27.5	11.8	52	24	-16	12	68	1.54	5.3	T	NW	....	12	10	9	12	..	..
Mt. Vernon	22 4	....	....	58	24	-11	12	69	....	....	.....	....	....	....	....	....	....	..	..
Mt. Ayr	28.9	42.3	15.5	67	21	- 4	1, 2	71	0.59	4.0	.....	NW	....	....	....	....	4	..	..
Muscatine	25.3	....	....	59	....	- 7	....	66	1.27	13.1	.....	....	....	....	....	....	9	..	..
Newton	21.4	31.8	10.9	56	24	-11	1	67	1.11	12.0	.....	NW	....	12	8	11	7	..	1
Omaha	27.0	35 5	18.0	60	23	- 5	1	65	1.13	8.0	.....	NW	....	10	9	12	8	..	..
Osage	16.1	....	....	....	....	....	....	....	1.65	6.0	.....	....	....	9	4	18	6	..	1
Oskaloosa	23.9	34.3	14.4	59	24	- 9	4	68	0.94	8.6	.....	NW	....	12	2	17	9	..	..
Ovid	25.2	35.5	14.8	62	22	- 6	1	68	1.22	9.0	.....	Nw-Sw	....	7	9	15	6	1	1
Panama	22.1	32.7	11.6	55	24	-11	1	66	1.26	5.8	.....	SE	....	11	4	16	7	..	..
Richland	22.4	....	....	....	....	....	....	....	1.29	14.8	.....	....	....	8	9	14	6	..	1
Rockwell City	....	....	....	....	....	....	....	....	0.68	....	.....	....	....	17	0	14	2	..	..
Rock Rapids	17.7	29.5	5.9	42	22	-16	1, 12	58	1.15	4.0	.....	S	....	3	21	7	7	..	..
Sac City	18.7	26.3	11.1	57	24	-10	1	67	1.65	8.0	.....	NW	....	15	10	6	6	1	1
Seymour	27.6	39.1	16.1	60	24	-10	1	70	1.67	14.0	.....	NW	....	18	5	8	6	..	..
Sibley	16.2	27.5	4.9	44	23	-21	1	65	1.43	4 8	.....	NW	....	10	11	10	4	..	..
Sioux City	20.0	29.0	10.9	49	4	- 8	12	57	1.57	....	.....	NW	....	10	11	10	7	..	..
Storm Lake	18.6	27.2	10.2	46	24	-10	1	56	1.46	6.6	.....	NW	....	9	12	10	8	1	1
Tipton	23.6	33.1	14.1	58	24	10	1	68	1.39	13.5	.....	NW	....	11	16	4	6	..	1
Villisca	24.2	34.4	14.0	58	24	0	2	58	0.46	....	.....	NW	....	....	....	....	4	..	..
Vinton	21.0	....	....	52	24	- 8	1	60	0.64	5.0	.....	NW	....	14	11	6	5	..	1
Washington	25.9	....	....	62	24	- 7	1	69	1.14	....	.....	SW	....	....	....	....	6	..	..
Webster City	21.0	....	....	52	24	- 9	1	61	1.04	2.3	0.2	SE	....	9	11	11	4	..	..
West Bend	16.0	....	....	....	....	....	....	....	1.26	12.6	.....	....	....	....	....	....	4	..	..
Williams	18.3	....	....	51	24	-20	12	71	0.96	2.9	.....	NW	....	6	18	7	10	..	..
Winterset	25.0	33.0	16.8	58	24	- 9	1	67	1.25	12.5	.....	NW	....	....	....	....	3	..	..
Means	22.0	32 2	12.2	55.7	..	-9.5	....	68.4	13.1	7.6	.....	NW	....	9.6	11.1	12.1	7.2	..	..

SUMMARY

STATIONS.	JANUARY.					FEBRUARY.					MARCH.					APRIL.					MAY.				JUNE.			
	Mean.	Maximum.	Minimum.	Total precip.	Total snowfall.	Mean.	Maximum.	Minimum.	Total precip.	Total snowfall.	Mean.	Maximum.	Minimum.	Total precip.	Total snowfall.	Mean.	Maximum.	Minimum.	Total precip.	Total snowfall.	Mean.	Maximum.	Minimum.	Total precip.	Mean.	Maximum.	Minimum.	Total precip.
Algona	8.1	34	-18	0.31	3.5	11.7	38	-24	2.04	?	28.4	66	-4	2.20	8.0	48.6	76	24	4.25	0	57.0	86	36	2.31	73.2	91	56	1.69
Alta	7.4	37	-18	0.26	2.5	11.0	37	-22	1.32	?	26.7	61	-8	2.60	6.0	41.5	75	18	3.14	0	54.6	86	31	3.65	70.8	89	44	5.68
Ames (Jos. J. Eggerton)	6.4	39	-21	0.28	?	13.2	40	-24	1.88	?	30.1	73	-5	2.04	2.7	44.0	77	17	5.22	0	55.0	83	31	4.33	69.5	90	47	4.90
Ames (W. H. Heileman)				0.51					2.11					2.11					2.10					4.25				
Ames (4 mi. sw. of)	10.1					17.9	44	-20	1.37	6.0	51.1	70	-4	1.73	2.2	44.3	76	22	2.42	0	54.5	82	32	4.89	72.7	94	50	4.70
Amana	7.5	39	-19	0.55	4.9	15.6	40	-17	1.35	?	32.3	71	3	2.53	2.0	45.5	83	24	4.68	?	56.5	85	32	2.29	71.2	93	48	4.26
Atlantic	12.8	44	-21	0.28	2.8	18.3	46	-21	1.22	?	32.7	74	-3	1.58	6.2	47.0	83	18	2.68		57.4	89	26	3.64	71.7	95	40	7.56
Audubon	11.0	40	-17	0.48	4.6	15.3	40	-20	1.52	?	31.0	75	-3	1.55	1.0	45.9	76	20	3.21		58.0	90	28	4.54	71.6	92	44	4.93
Belle Plaine	6.7	39	-20	0.90	9.0	14.8	41	-19	1.20	?	31.7	73	2	2.49	4.5	45.0	84	21	3.55	5.0	56.6	85	30	3.24	71.0	91	47	3.43
Blakeville	6.1			2.20	22.0	14.0			2.55	?	29.8			3.54	11.0	43.0			3.94	0	55.3			3.36	71.8	93	54	3.38
Bonaparte	12.7	42	-14	0.60	2.0	20.9	44	-14	1.42	?	36.0	79	-5	2.79	?	48.8	89	23	5.11	?	58.3	86	34	4.31	71.9	95	49	4.47
Carroll			-15	0.35	3.5	18.1	40	-21	1.95	?	30.1	67	-2	1.75	?	44.9	75	21	3.81	8.0	56.7	84	31	5.82	72.0	92	44	3.54
Cedar Falls	5.6	37	-20	1.40	14.0	14.6	38	-23	1.90	12.0	31.1	67	2	2.78	0.7										70.2	91	47	3.15
Cedar Rapids	9.3	40	-15	0.72	7.5	17.4	42	-16	1.82	8.5	33.1	68	-5	2.99	3.0	45.9	78	24	3.89	?	57.2	81	34	2.79	72.2	90	52	4.86
Centerville	12.6	41	-18	0.55	6.5	21.2	46	-16	2.10	7.0	35.8	72	2	1.10	1.0	18.2	85	18	4.80	6.0	60.1	88	38	5.24	72.2	94	48	3.05
Charles City	2.3	31	-24	1.49	13.0	10.4	40	-28	2.28	14.5	26.5	62	-12	2.51	7.8	41.7	70	18	4.89	8.0	54.2	82	28	2.72	72.0	90	50	2.71
Clarinda	13.2	41	-9	0.68	4.0	18.2	46	-15	1.12	8.0	33.0	74	2	1.73	6.0	47.4	81	23	3.11	1.0	57.9	82	32	3.17	70.5	88	52	4.12
Clinton	8.3	39	-20	2.01	15.3	16.7	40	-16	1.68	11.5	34.0	70	5	2.75	2.5	47.5	87	24	5.48	0.5	57.6	86	31	3.80	71.8	92	51	3.42
College Springs	12.6	43	-13	0.20	2.0	18.9	44	-17	1.89	13.0	33.7	79	0	1.80	5.5	48.8	80	24	3.80	?	58.5	85	34	3.61	70.2	92	49	4.84
Corning	13.1	42	-14	0.25	2.5	18.3	42	-17	0.45	15.0	33.2	74	0	2.31	9.8	47.0	79	20	3.26	4.0	57.1	82	29	3.27	69.4	87	47	3.32
Cresco	2.5	30	-24	1.16	10.0	9.3	44	-27	1.23	6.0						40.2	77	15	5.95	?	52.9	82	30	2.79	68.2	89	45	4.14
Decorah	-0.5	37	-36	?	?	11.9	48	-24	1.30	?																		
Delaware	1.6			0.86	10.4	11.4	40	-23	0.97	3.0	27.8	65	0	2.31	?	41.7	84	22	3.71	3.0	55.1	82	40	2.92	69.9	92	55	4.29
Denison	14.5	41	-15	1.15	11.5	16.8	47	-19	2.45	24.5	31.9	69	-2	0.64	?	46.2	77	21	5.18	12.0				5.21	91.0		52	3.05
Eagle Grove	2.6			0.70	7.0	8.8			1.40	14.0	25.1	54	-8	2.37	3.7	40.2	66	15	7.01	10.1	55.4	82	34	4.35	70.4			5.90
Elkader						12.5	41	-27	1.13	?						43.1	81	22	4.50	?	55.2	85	29	2.63	70.6	94	46	2.92
Emmetsburg	9.0	50	-13	0.30	3.0	10.1	40	-26	2.50	?	31.2	67	-4	2.15	5.0	41.2	80	19	4.49	7.0	55.3	85	30	3.54	69.6	93	44	1.75
Fayette	5.2	32	-24	1.05	12.2	13.0	38	-22	1.48	9.5						42.7	78	19	3.75	6.0	54.1	83	28	3.35	69.6	93	40	3.45
Ft. Madison	10.9			1.66	9.5	25.0	48	-10	1.39	12.5	39.8	70	9	3.98	0.7	52.8	89	15	4.38	?	62.6	90	42	4.85	75.6	92	61	2.13
Fulton	10.6	32	-26	1.80	14.5	16.1			1.05	6.0	32.3		4	4.40	3.0	46.4	82	30	3.50	?								
Galva	12.6	42	-15	0.20	2.0	14.4	39	-20	0.70	7.0						44.1	80	20	2.20	4.5								
Glenwood	18.2	54	-9	0.73	5.2	22.1	60	-18	0.06	?	37.9	84	2	0.97	5.0	52.0	96	24	2.04	?	61.3	96	33	4.93				
Grand Meadow	5.1			1.65	14.0	14.4	40	-24	1.76	9.5	28.9			2.29	7.2	42.1	74	26	4.11	?	54.7	80	36	3.18	68.8	92	54	3.90
Greenfield	10.6	39	-17	0.45	5.5	16.0	43	-21	1.37	8.4	32.4	73	-2	1.96	3.2	47.8	80	23	5.53	4.1	57.9	85	31	3.49	71.2	90	46	3.06
Grinnell	8.7	33	-16	0.12	1.2	17.9	40	-17	0.82	1.8	32.5	67	4	1.60	3.2	44.8	74	25	3.35	0.8	54.9	77	34	2.85				
Grundy Center	4.7	38	-18	0.50	4.3	12.1	40	-22	1.12	47.0	29.2	65	0	2.40	4.2	43.6	76	22	5.52	7.0	55.2	82	34	2.70	74.5	89	56	3.07
Hampton	4.0	35	-19	0.82	7.0	10.9	36	-23	2.91	15.5	26.7	65	-4	2.56	3.4	40.7	77	19	6.18	8.5	53.6	83	29	2.94	69.3	93	45	1.70
Hopeville	11.8	40	-15	0.17	1.5	18.5	46	-16	0.50	4.0	33.8	71	1	0.63	1.5	46.7	79	23	4.03	?	57.4	83	33	3.35	69.9	88	52	1.02
Hopkinton	10.1			1.20	12.0	18.9	42	-17	1.35	6.0	32.8	68	5	2.81	7.0	46.0	78	28	?	?	56.5	80	36	3.23	71.0	91	52	5.63
Humboldt																								2.29				3.78
Independence	6.6	38	-21	1.41	14.2	13.3	40	-23	1.64	9.5	30.9	67	-2	1.75	4.5	42.3		19	1.95	4.0	54.8	84	28	2.52	69.0	91	47	3.57
Indianola	10.9	41	-14	.34	5.0	18.8	45	-17	.90	2.0	35.0	74	2	.80	0.2	47.7	81	22	5.05	2.0	58.0	83	30	4.73	70.4	89	48	.86
Iowa City	10.2	42	-20	1.18	9.6	1.86	41	-18	1.75	?	34.6	72	-4	2.82	2.5	48.5	88	24	4.37	0	57.4	85	31	1.79	71.4	99	45	3.01
Iowa Falls	2.9	56	-21	0.52	4.0						26.7	65	-6	2.22	6.0	40.5	76	20	4.45	5.0	54.4	82	30	3.84	69.4	89	45	2.79
Jefferson						16.8	40	-22	1.20	11.0	30.8	73	-6								59.0	86	29	5.50	71.6	92	42	44.6
Keosauqua	14.4	43	-10	0.49	3.3	22.0	45	-11	1.44	9.0	36.8	71	6	2.35	?	49.9	86	25	4.82	0	59.4	89	36	4.48	72.9	95	49	2.72
Larrabee	9.0	39	-19	0.13	1.8	12.7	40	-23	0.79	8.5	26.9	62	-7	2.47	9.5	42.8	80	18	3.93	9.0	55.8	87	32	4.11	71.1	93	43	2.19
Le Claire				1.34					1.12					2.64					5.51					1.37				3.74
Logan	14.8	40	-12	0.40	4.0	17.4	49	-16	1.50	?	31.1	73	0	0.84	?	47.3	86	20	2.10	0	58.5	86	32	4.73	71.8	93	50	3.97
Maquoketa	7.2			0.86	?	16.0			1.72	6.0						45.8			4.30		57.4			1.77				
Marshalltown	10.1	38	-14	0.17	4.5	17.4	44	-17	0.62	3.8	32.8	71	1	1.97	3.2	47.1	78	25	3.98	1.5	57.1	81	35	3.10	70.6	87	49	4.34
Maxon	9.1			0.25	2.5	17.5			1.00	?	32.6			2.56	0.5	46.6			4.63	T	57.7			3.38	72.5			5.88
Mechanicsville	7.5	41	-16	1.44	14.3						31.4	69	2	2.79	5.8	44.2	86	23	4.24	3.7	57.9	82	33	3.15	69.3	90	47	2.86
Monticello	5.6	40	-22	1.18	9.0	14.6	46	-20	1.32	4.2	29.4	68	-4	2.44	?	43.6	84	21	3.58	2	54.8	83	28	2.57	70.4	95	49	5.82
Mt. Pleasant	11.6	39		2.10	?	19.9	43		1.05	?	34.8	71		2.65	?	46.8	85		4.02	?	57.4	80	35	0	71.4	89	4	4.12
Mt. Vernon	7.9					17.4					32.7					47.0					57.9	84	36	2.35	72.9	94	54	4.30
Mt. Ayr	16.4	48	-12	0.16	?						34.8	70	3	2.13	?	49.3	83	20	3.31	?	59.0	87	33	5.09	71.9	91	50	4.14
Murray	10.9	58	-13	0.23	2.3	18.4	47	-16	0.60	3.8	33.7	72	1	0.94	1.4	46.4	77	23	4.70	3.0	56.4	85	32	4.44	70.4	93	49	5.37
Muscatine	10.3	41	-19	1.35	10.1	19.5	42	-14	1.60	4.8	34.4	75	5	3.49	2.5	47.8	88	27	5.33	2.0	55.0	84	35	2.35	71.2	92	49	3.66
Newton	9.0	40	-17	0.67	9.8	16.9	41	-19	1.00	6.8	33.5	75	1	1.33	3.1	46.3	82	21	5.41	6.0	57.4	84	33	2.92	72.0	95	48	3.65
Osage	2.6			0.85	9.0	9.7			2.33	14.8	23.8			2.46	7.0	38.6			5.14	22.0	52.6			3.85				
Oskaloosa	10.5	40	-21	0.59	5.4	18.7	42	-16	1.12	2.2	34.0	74	4	1.90	1.8	47.1	85	22	3.39	20	57.1	84	31	2.70	70.6	91	48	4.52
Ovid																					59.9			3.26	70.0	93	48	4.53
Panama	12.2	41	-13	0.29	2.9	15.9	42	-18	1.16	10.9	30.3	70	2	1.10	0.7	45.8	81	21	2.47	2.9	56.7	82	33	5.17	59.6	88	45	4.48
Richland	8.6			0.92	9.0	18.2			1.15	1.8	32.3			3.03	0.8	47.0	85	27	4.63	?	58.4			3.24	71.4	100	53	3.35
Rock Rapids																					56.2	86	32	4.69	70.8	95	43	1.36
Sac City	7.8	38	-14	0.14	1.0	11.3	40	-21	1.20	14.0						42.0	66	22	2.60	?	51.4	80	33	2.25	71.2	89	54	5.79
Seymour																49.2	87	24	5.37	1.9	58.2	85	32	3.70	70.8	95	47	5.06
Sibley																					55.2	82	28	1.65	69.1	90	40	2.41
Storm Lake	11.1	37	-16	0.17	1.8	13.9	39	-21	1.48	15.7	27.4	59	5	2.60	5.0	42.9	78	20	2.72	11.1	56.3	82	33	3.41	72.0	92	53	3.53
Tipton	9.3	43	-18	0.79	14.0	16.8	40	-18	2.30	2.2	33.8	77	2	3.77	4.0	45.3	86	23	4.63	3.7	58.7	87	34	2.93	71.4	93	48	2.77
Villisca						21.5	55	-16	0.21	2.1	33.5	70	2	3.09	?	49.6	82	24	1.24	0.3	59.7	85	34	2.96	72.9	90	50	3.10
Vinton	6.6			0.88	10.0	15.9	37	-17	0.49	1.5	31.2	69	1	1.95	1.5	44.4	77	25	3.22	10.0	55.8	82	35	2.60	70.4	89	55	3.19
Washington	11.9	40	-14	0.89	5.0	20.6	48	-15	0.30	?	36.6	75	6	2.70	2.0	49.5	84	32	4.21	4.0	59.9	92	35	1.70	76.5	100	50	3.63
Webster City	8.6			0.73	4.3	13.3			1.79	7.4	28.2	72	-4	1.18	2.5	41.1	78	25	4.12	3.8	54.7	86	33	3.62	70.5	98	46	2.78
Williams	5.1			0.35	2.6	12.5	39	-24	2.30	9.1	27.4	75	-5	1.88	?	41.3	75	20	5.00	?	54.3	83	36	3.68	68.7	92	52	3.10
Winterset	11.8	42	-16	0.52	5.2	17.4	44	-18	0.94	4.5	32.2	75	0	1.85	?	48.3	82	19	5.65	0	57.8	87	32	3.16	70.8	92	50	5.96
Means	9.0			0.70	6.9	11.5			1.30	8.1	31.7			2.22	3.9	45.3			4.07	5.8	55.3			3.45	71.1			3.22

FOR 1893.

JULY.				AUGUST.				SEPTEMBER.				OCTOBER.				NOVEMBER.					DECEMBER.					ANNUAL.				
Mean.	Maximum.	Minimum.	Total precip.	Mean.	Maximum.	Minimum.	Total precip.	Mean.	Maximum.	Minimum.	Total precip.	Mean.	Maximum.	Minimum.	Total precip.	Mean.	Maximum.	Minimum.	Total precip.	Total snowfall.	Mean.	Maximum.	Minimum.	Total precip.	Total snowfall.	Mean.	Maximum.	Minimum.	Total precip.	Total snowfall.
73.2	94	62	1.87	68.5	96	46	0.40	62.8	93	27	1.90	49.4	85	15	0.02	31	72	-10	0.60	4.5	17.7	44	-14	1.60	5.0	44.2	96	-24	19.19	21.0
72.9	93	53	4.61	68 5	95	40	1.73	64 6	95	24	1.02	49 9	85	15	0.23	31	0	74	-9	0.96	6.2	17.0	48	-13	1.40	4.2	42.9	95	-22	24.40	.....
73.2	95	50	2 00	68.0	97	38	1.62	62 2	96	24	1.87	51.1	87	15	0.85	32.4	72	-3	0.65	?	16.5	56	-12	1.28	?	43.5	97	-24	26.92	.....
.....	.....	.....	2.95	.....	.....	.....	1.84	.....	.....	.....	1.89	.....	.....	.....	0 43	3.0	.....	.....	1.35	?	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
79.0	102	58	2.47	72.5	98	41	0 08	67 7	100	30	1 86	54 6	88	20	0.52	36.3	80	-2	0.62	2.3	22.5	56	-8	1.05	8.6	46.9	102	.....	.....	.....
75.3	96	51	2.70	69.4	96	39	3.02	63.4	93	28	2.53	51.9	82	19	2.02	33.1	70	-1	1.73	4.0	21.4	57	-10	1.22	5.0	45 3	96	-19	29.00	.....
76.1	102	47	2.58	.....	.....	.....	.....	66 2	100	24	2.58	52.9	96	21	1 36	34	8	78	-3	0 77	2.3	21.7	55	-10	1.95	9.0	.....	.....	.....	.....
74.9	97	50	2.38	71.4	97	36	1.98	63 5	94	25	1 48	50.0	84	18	0.18	33.5	70	-4	1.00	8.0	22	56	-10	1.55	8 0	45 7	97	-20	24 80	.....
73.8	95	50	2.24	69.2	87	40	1.99	65.3	92	26	1.96	51.8	84	17	2.67	32.8	71	-5	1.51	7.5	20.2	55	-10	1.17	9.5	44.9	95	-20	26.35	.....
77.4	96	64	2.66	72.1	96	49	1.12	67.6	100	32	0.85	53 6	95	29	4.56	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	100	.....	.....	.....
77.0	98	52	2.46	71 6	101	40	2.02	67.5	100	31	5.73	55.1	91	23	1.45	36.5	75	4	1.65	2.5	25.7	63	-8	1.17	7.0	48.5	101	-14	32.38	....
75.2	94	50	4.75	68.5	94	38	2.92	62.9	93	23	1 36	51.0	87	18	1.10	31.6	72	-5	0 77	5.0	18.7	56	-10	1.37	12 5	.....	94	-21	29.59	.....
75.0	.....	.....	4.47	70.0	96	36	1.09	64.2	99	36	1.75	53.1	85	15	3.53	32.3	75	-7	0.55	5.0	.....	.....	.....	.....	.....	.....	.....	-23	.....	.....
76.3	94	58	1.98	70.2	92	45	2.47	64 8	90	33	2.85	52.7	80	23	2.63	34.3	68	3	1.24	5.0	22 9	58	-7	2.40	15.4	46.4	94	-16	30.67	.....
77.6	95	52	5.67	73 0	97	44	3.20	65.9	95	24	4.20	54.3	81	25	1.30	37	3	75	2	1.45	1.5	25.4	70	-7	2.80	7.5	49.0	97	-18	32.46	29.5
73.4	91	54	4.72	68.5	96	36	1.20	62.9	93	28	1.77	52 5	84	13	1.28	31.1	70	-10	1.09	7.0	16.3	50	-16	1.76	3.5	42 6	96	-28	28.42	53.8
75.3	97	58	8.84	69.6	92	44	6.22	65.9	90	36	2.38	54.0	80	26	0.09	35.2	70	-2	1.05	3.0	25.4	57	-3	0.76	6.5	47.1	97	-15	33.27	28.5
76.3	95	53	2.26	70 5	96	40	1.20	64.0	96	31	4 25	52.7	82	18	0.68	31.3	73	1	1 77	7.0	23 8	61	-11	1.29	6.5	.....	.....	.....	.....	.....
74.3	97	55	6.13	68.0	90	42	3.54	.....	.....	.....	3.29	.....	.....	.....	.....	36.6	72	6	0.79	1.5	26.5	59	-4	0 99	7.0	.....	.....	.....	.....	.....
73.2	95	52	4.18	67.7	90	40	6.16	64.7	91	29	1.70	54.2	81	21	0.22	37.4	72	2	1.10	0 2	26.3	59	-5	0.82	3.5	46.8	95	-17	27.54	21.5
71.1	93	50	3.85	67.4	94	38	1.20	60.5	92	26	2.08	49.0	81	14	3.40	29.5	72	-12	0.84	0.0	15.4	48	-17	1.17	3 5	.....	.....	.....	.....	.....
72.2	93	51	6.05	68.0	93	38	0.50	66.6	96	37	3 36	50 8	82	14	2 13	31.4	79	-13	1.51	4.5	19 2	53	-13	1.73	5.2	.....	.....	.....	.....	.....
74.1	96	...	3.98	66.9	96	46	1.06	59.8	98	30	2.39	48 3	83	19	3.27	29.3	65	-8	1.81	5.5	18.8	52	-10	1.44	5.3	42.0	98	...	29.01	.....
74.9	.....	.....	2.46	.....	.....	.....	3.79	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	20.6	55	-5	0.60	6.0	.....	.....	.....	.....	.....
72.7	90	58	5.35	67.0	90	38	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
74 1	97	50	2.93	67 4	98	36	0.85	62.6	100	23	1.48	51 6	85	16	3.23	32.3	73	-8	1.25	6.0	19.0	53	-17	1.85	6.0	.....	.....	.....	.....	.....
72.8	97	51	3.56	68.6	97	39	2 36	.....	.....	.....	.....	49 8	85	10	0.15	30.1	76	-8	0.10	1.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
73.0	96	48	4 62	69.2	99	35	2.04	67.7	100	37	1.97	50.5	83	15	3.19	32 5	73	-9	1.40	6.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
79.3	95	65	2.15	74 3	95	52	.....	69.2	93	40	4.88	57.4	84	28	0 35	38.8	68	8	2.20	3 5	29.0	60	-2	1.51	8 5	51.7	95	.....	.....	34.7
.....	.....	.....	.....	68.9	.....	.....	1.75	64.9	.....	.....	1.14	52 2	82	16	0 12	32.8	.....	.....	1.05	10.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	68 3	95	37	2.96	63 5	95	26	1 48	50 4	86	16	0.06	33.5	74	-4	0.79	7.9	18 3	48	-11	1.54	7.3	.....	.....	.....	.....	.....
.....	.....	.....	.....	73.6	98	42	3.85	71.4	102	34	1 35	58 4	94	24	0.22	40	0	86	2	0.23	?	28.5	64	0	0.47	4.8	.....	.....	.....	.....	.....
70.0	90	56	5.72	66.8	90	42	1.70	61 1	86	31	2 01	50.4	74	22	3.02	32 3	67	-8	1.34	8 2	20.0	51	-13	1.86	6.0	.....	.....	.....	.....	.....
75.6	98	52	2.95	70.0	96	40	3.92	67.8	94	30	2.92	53 2	86	21	0.23	36	0	75	-1	0 80	2.3	33.3	60	-10	1.86	15.3	46.8	98	-21	26.66	38.9
.....	.....	.....	.....	.....	.....	.....	.....	62.1	.....	.....	2.38	55.1	85	22	1.56	38	7	68	0	1.85	4.8	32.2	54	-10	2.62	8.0	.....	.....	.....	.....	.....
74.3	92	54	2.22	68.4	96	38	1.56	62.5	94	26	1 50	50.6	85	16	2.22	31	0	72	-9	1.11	3 0	19.0	50	-11	0 98	3.8	43 8	96	-22	24.90	29.3
73.2	96	50	4.36	68 3	96	37	1.15	62.2	94	24	1 54	50 3	84	13	1.63	30	8	73	-9	1 93	7.8	16.7	51	-13	1 38	3.6	42.2	96	-13	31.10	45.8
75.3	95	58	1.99	70.0	92	45	3.40	67.1	94	33	3.37	58 3	84	28	0.21	...	...	...	...	0.90	?	25	2	58	-5	0	53	3.6	.....	.....
76.5	92	61	2.75	71.0	92	45	1.25	67.6	98	34	3 50	55.2	79	29	3.51	37	4	...	...	2.10	7.3	33	3	52	-5	2	20	8.0	47.2	98	.....	.....	40.3
.....	.....	...	4.90	.....	.....	.....	2.13	.....	.....	.....	0 92	.....	.....	.....	0.10	.....	.....	.....	.....	0.31	4.0	.....	.....	.....	1.02	?	.....	.....	.....	.....	.....
73.9	96	51	1.73	67 9	.....	.....	0.75	63 6	96	26	1.15	53.1	83	18	3.65	33.9	72	-10	.63	6.5	20.0	52	-14	.70	6.2	44.1	....	-23	21.45	44.9
.....	.....	.....	.....	.....	.....	.....	.....	64 9	93	33	2 76	57.5	89	20	0.20	36.7	72	0	1.68	0.5	23	59	-12	1.10	7.4	.....	.....	.....	.....	.....
75.4	95	55	3.56	70.3	94	45	1.64	65.2	95	28	3 07	54 3	83	19	1.98	36	6	74	2	1.75	7.0	25	3	60	-9	1.52	11 8	47.3	99	-20	28.44	....
73 3	92	51	3.24	66.8	97	37	0.95	62 1	94	26	1 44	49 0	85	11	0.89	31	0	72	-7	1.45	3.5	16.7	50	-14	1.50	0	.....	.....	.....	.....	.....
73 4	96	53	3.63	79.2	96	37	1.76	66 0	97	28	1.58	56.1	85	20	0.45	36	5	70	-5	0.56	2.0	21.7	55	-10	0.99	8.0	.....	.....	.....	.....	.....
78.2	97	55	1.94	72.2	97	43	2.26	68.5	98	34	5.46	57.1	89	23	1.08	38.2	74	-7	1.24	2 8	27.1	61	-5	0.80	10.5	49.7	98	-11	29.08	.....
74.0	96	50	1.95	68 5	96	35	2.18	63.7	97	23	1.24	49.0	80	13	0.89	31.9	74	-9	0.95	8.0	17.4	48	-11	2.37	5.8	43.6	97	-19	23.10	40.6
.....	.....	.....	1.76	.....	.....	.....	.....	.....	.....	.....	2 01	.....	.....	.....	0.36	.....	.....	.....	1.56	.....	.....	.....	.....	1.40	.....	.....	.....	.....	.....	.....
74.8	97	53	3.62	70.0	94	37	1.99	66.8	95	31	1 35	55.9	88	22	0.15	35.0	72	0	0.53	6.0	23.5	60	-11	1.22	8.0	47.2	97	-16	22.40	....
75.0	95	68	2.07	69.3	96	52	1.62	62.3	92	32	3.22	47.7	..	..	0.78	53.3	72	0	0.53	6.0	23.6	..	...	1.10	4.5	.....	.....	.....	.....	.....
74.0	92	50	2.66	69.7	92	43	2.43	64.2	90	33	1 73	53.6	85	16	0.62	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
77.8	98	64	2.82	71.6	.....	.....	3 42	66.7	.....	.....	3.11	58.7	89	23	1.92	38.8	.....	.....	1.23	0.5	23.4	58	-10	1.25	8.5	47.3	.....	.....	31.45	.....
74.2	94	56	2.55	67.8	92	42	2.90	63.0	91	31	2.77	50.0	79	20	1.70	33.1	69	-1	1.62	14.0	21.9	56	-10	0.73	7.2	.....	.....	.....	.....	.....
74.0	94	50	1 92	68.2	95	39	1.23	62.6	90	29	2 50	49 9	81	16	2.08	31.0	68	-5	1.80	10.5	19.9	52	-16	1.54	5.8	43.7	95	-22	27.98	.....
76.4	90	...	1 43	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
77.4	.....	.....	2 60	.....	.....	.....	.....	65.9	92	33	3.70	51.0	79	22	4.12	34.2	71	-4	.....	.....	22.4	58	-11	.....	.....	.....	.....	.....	.....	.....
76.8	93	56	4.75	72.0	94	43	3.98	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.63	?	28.9	67	-4	0.59	4.0	.....	.....	.....	.....	.....
.....	.....	.....	1 60	.....	.....	.....	5 73	.....	.....	.....	3 37	.....	.....	.....	0.05	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
75.7	93	55	2.59	69.8	95	41	1.02	64.5	95	34	5.05	53.0	82	20	1.14	35.3	72	0	2.40	8.0	25.3	59	-7	1.27	13.1	46.8	95	-19	31.20	40.5
74.0	95	55	5.24	70.0	95	43	3.35	64.5	93	30	2.11	53.2	87	18	1.17	34.3	71	-5	1.43	6.5	21.4	56	-11	1.11	12.0	46.1	.....	.....	29.39	44.2
.....	.....	.....	.....	64.4	.....	.....	2.57	57.0	.....	.....	1.81	46.2	.....	.....	1.69	37.3	.....	.....	0.73	5.5	16.1	.....	.....	1.65	6.0	.....	.....	.....	.....	.....
75.5	96	52	1.49	70.1	99	39	1.69	65.8	97	29	2 37	53.5	88	20	1.20	35.9	73	0	1.24	2.5	23.9	59	-9	0.94	8.6	46.9	99	-16	23.50	40.5
76.0	92	56	2.40	70.9	96	42	3 55	67.6	96	30	3.36	53 2	88	23	1.32	36	2	71	1	1.16	1.0	25	2	62	-6	1.22	9.0	.....	.....	.....
73.3	96	51	3 98	68.4	94	40	2.32	66 0	93	29	1.35	53.1	89	21	0 12	35	0	72	-4	0.46	2.9	22	1	55	-11	1.26	5.8	45.8	96	-18	24.16	26.1
76.1	.....	.....	2.21	70.1	100	43	1.91	65.5	.....	.....	5.30	53 8	...	...	1.64	33 5	...	...	1.96	4.5	22.4	...	...	1.29	14.8	46.4	.....	.....	30.81	.....
74.8	99	48	4.91	68.2	94	34	1.24	61 8	98	18	0.74	47.5	80	15	1.05	31.6	72	-6	0.30	3.0	17 7	42	-16	1.15	4.0	.....	.....	.....	.....	.....
74.5	93	54	2.12	64 2	95	39	2.05	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	18.7	57	-10	1.65	8.0	.....	.....	.....	.....	.....
76.5	96	55	2.75	70 2	98	42	4 67	66.1	95	30	5.49	53 7	87	15	1.20	.....	.....	.....	.....	.....	27.6	60	-10	1.67	14.0	.....	.....	.....	.....	.....
69.3	93	47	3.37	66 4	92	35	2.26	60.9	93	18	0 88	.....	.....	.....	0.53	30.4	74	-9	0.17	2.5	16.2	44	-21	1.43	4.8	.....	.....	.....	.....	.....
74.9	95	57	3.99	71.0	94	44	1.90	66.7	92	27	0 95	51.7	81	17	0.10	33.8	73	-3	1.03	6.7	18.6	46	-10	1.46	6 6	45.0	95	-21	23.15	46.9
75.9	97	55	1.69	.....	.....	.....	.....	64.9	97	32	3 39	48.7	80	21	1.71	34	8	70	0	2.00	10.0	23	6	58	-10	1.39	13.5	.....	.....	.....
78.1	95	60	5.72	70 1	91	42	6 32	62.4	88	32	1 99	53 2	80	10	0.24	38.4	70	-3	0.05	0.5	24.2	58	0	.46	?	.....	.....	.....	.....	.....
74.5	94	59	1.65	69.1	94	41	1.40	63.0	.....	.....	1.85	53 1	81	20	2.57	32.7	.....	.....	.....	.....	21.0	52	-8	0.64	5.0	44.7	.....	.....	.....	.....
80.8	100	56	2.27	74.4	98	47	1.65	68.4	.....	.....	4.24	54.9	88	23	1.15	36.9	72	...	0.90	?	25.9	62	-7	1.14	?	49.7	100	-15	24.98	.....
75.3	96	60	3.90	68 7	99	40	2 90	65.4	94	30	1.00	50 3	86	22	0.50	31.0	74	-3	1.40	1.8	21.0	52	-9	1.04	2.3	44.0	99	...	24.94	22.1
72.6	93	57	5.93	68.4	96	....	1.79	61.4	94	25	1.49	49 7	84	11	1.06	30.2	73	-9	1.57	5.4	18 3	51	-20	0.96	2.9	42.5	.....	.....	29.01	.....
76.5	98	54	2.00	70.8	100	43	2.91	66.2	96	31	3.77	54 8	86	22	0.15	.....	.....	.....	.....	.....	25.0	58	-9	1.25	12.5	.....	.....	.....	.....	.....
75.0	.....	.....	3.11	68.5	.....	.....	2.32	64.6	.....	.....	2.41	52.4	.....	.....	1.32	33.9	.....	.....	1.12	4.9	23.8	.....	.....	1.31	4.5	44.3	.....	.....	2.74	36.0

DAILY AND MONTHLY MEAN TEMPERATURE FOR DECEMBER, 1893.

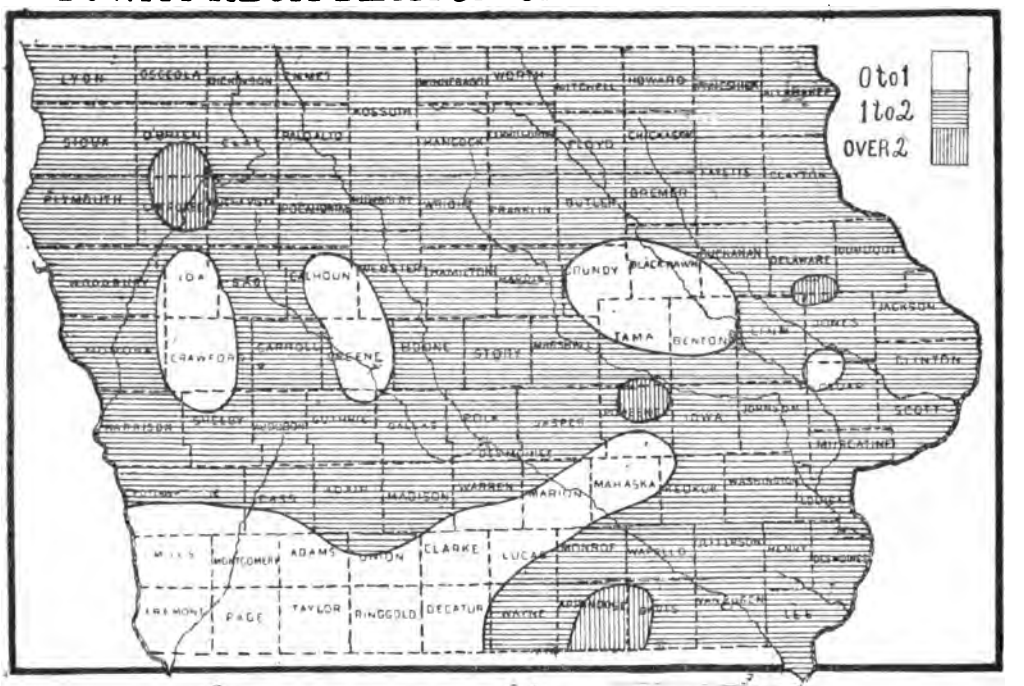
STATIONS.	DATE.																													Monthly Mean.
	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	31st.	
Algona	-5	7	5	19	12	14	20	28	11	8	12	-9	10	29	21	11	14	20	10	3	34	38	38	39	11	22	28	23	8	18	37	17.7
Ames (J. J. Eggerton)	-2	6	4	10	18	12	20	18	18	4	18	-2	2	16	30	16	10	19	17	16	28	40	33	44	20	20	23	23	10	8	16	16.5
Ames (4 mi. sw. of)	11	10	7	23	14	20	29	26	22	10	21	1	10	30	26	18	12	32	17	25	30	42	31	50	20	26	30	30	18	18	30	22.5
Amana	-2	8	5	12	23	9	16	26	24	7	22	-2	6	26	36	17	8	27	17	18	37	47	39	52	25	24	29	36	19	23	23	21 4
Atlantic	0	12	4	16	16	10	20	27	17	8	18	6	10	28	28	20	18	33	20	22	39	40	40	30	31	26	29	34	20	12	34	21.7
Audubon	2	11	4	17	25	14	22	24	20	10	17	6	8	27	24	18	14	30	16	19	34	42	40	53	32	23	28	38	24	22	21	22.2
Belle Plaine	-2	7	4	10	20	10	20	22	21	5	24	-3	6	26	36	13	8	26	16	16	35	44	43	50	24	22	28	32	17	17	27	20.2
Bonaparte	4	10	10	12	30	14	18	29	28	14	30	12	10	28	45	20	12	39	24	20	40	50	45	54	38	24	30	30	24	21	22	25.7
Carroll	0	4	2	16	26	16	18	28	14	8	6	-2	7	19	21	10	15	28	14	16	31	37	39	48	14	20	29	29	17	9	24	18.7
Cedar Rapids	0	10	7	14	12	19	22	28	34		22	4	4	24	38	20	16	31	16	20	36	41	40	47	30	26	34	34	22	20	26	22.9
Centerville	12	11	6	14	32	24	18	25	21	23	25	30	14	25	30	37	17	20	40	43	43	42	44	44	43	23	30	40	30	45	40	35	29.4
Charles City	-8	2	0	14	16	10	18	26	18	8	15	-10	4	28	26	8	0	14	6	11	28	40	35	43	26	21	27	30	14	14	32	16.3
Clarinda	6	14	6	20	27	21	26	32	24	18	22	6	14	32	28	20	19	32	20	26	42	46	43	48	28	26	33	34	24	17	33	25.4
College Springs	10	12	6	16	25	26	28	35	18	17	23	10	10	33	20	21	18	33	29	30	45	46	44	49	22	27	37	36	24	29	42	26.5
Corning	3	14	7	18	28	18	24	32	18	14	25	13	11	28	35	20	16	34	25	26	44	54	44	54	34	27	31	36	23	18	35	26.3
Cresco	-10	2	1	10	10	7	14	26	18	6	12	-10	2	22	28	12	2	19	4	18	29	36	33	45	32	21	26	26	26	11	11	15.4
Davenport	-2	10	9	14	25	10	18	35	29	10	28	2	6	26	43	20	9	26	16	22	41	50	44	54	32	26	31	40	24	25	29	24.0
Decorah	-2	6	2	24	12	12	22	28	20	10	6	-8	6	22	22	8	20	19	6	22	33	34	42	43	28	21	33	24	14	25	32	19.2
Delaware	-4	5	0	15	16	6	19	28	22	5	16	-6	2	28	33	18	4	30	5	14	36	40	36	49	30	24	28	31	19	16	26	18.8
Denison	4	12	5	21	26	16	26	29	22	12	14	2	10	28	35	21	16	28	17	20	34	38	38	42	12	20	28	26	18	8	24	20.6
Des Moines	-1	9	5	18	27	14	21	26	22	8	18	2	6	18	34	18	12	30	21	22	42	49	42	55	32	26	32	37	21	17	30	23.0
Dubuque	-2	4	10	12	22	9	24	28	29	10	21	0	2	24	34	20	9	23	13	17	37	45	40	51	36	28	32	36	24	18	28	22.0
Elkader	-4	2	6	9	18	10	16	28	22	9	18	-3	-1	24	32	18	7	23	11	15	35	37	36	46	30	24	29	32	20	15	26	19.0
Ft. Madison	3	10	7	24	24	10	28	36	29	16	33	11	18	36	43	26	18	36	25	30	45	53	54	58	33	29	35	40	29	24	32	29.0
Galva	-2	1	3	16	26	18	26	23	21	14	12	2	3	22	32	14	16	28	16	20	27	29	32	42	24	16	20	27	20	8	26	18.3
Glenwood	13	19	10	26	32	31	30	40	28	17	22	10	13	32	37	23	24	36	22	26	46	43	45	54	32	25	27	35	23	17	40	28.5
Grand Meadow	6	4	6	18	15	12	20	26	18	13	16	8	4	28	32	16	6	21	6	22	32	40	38	50	30	25	32	30	20	15	24	20.0
Greenfield	2	10	3	17	22	17	24	34	23	11	20	4	8	28	28	18	14	32	17	22	40	46	42	54	32	24	31	34	20	14	30	23.3
Grinnell	-3	6	3	14	22	15	21	24	26	10	17	8	6	25	34	18	14	26	18	20	36	46	42	50	36	20	32	36	22	16	31	22.2
Grundy Center	-2	6	4	22	16	14	25	30	16	6	-8	-6	11	30	20	11	14	22	12	18	36	38	40	40	20	24	32	32	22	12	16	19.0
Hampton	-6	4	2	16	12	10	19	23	14	5	14	-8	2	23	28	13	7	26	11	12	32	34	38	48	17	20	28	32	26	11	25	16.7
Hopeville	3	12	4	16	26	17	24	32	24	12	28	10	11	30	34	18	16	32	22	24	40	51	44	54	34	25	34	36	21	18	32	25.2
Hopkinton	0	8	10	18	25	12	20	29	30	11	26	2	4	30	38	20	8	31	13	17	37	45	39	48	35	26	36	36	26	19	31	23.3
Independence	1	2	3	9	23	7	16	24	25	10	18	8	0	21	32	21	10	30	14	13	30	38	35	45	38	21	28	36	24	14	26	20.0
Indianola	0	10	6	15	27	15	22	29	28	12	21	12	4		36	18	17	26	27	22	42	39	36	54		26	30	46	15	15	30	23.3
Iowa City	0	4	12	11	29	29	14	28	35	20	25	20	2	22	41	30	12	28	26	21	40	48	43	48	43	23	28	37	28	12	30	25.3
Iowa Falls	-1	3	2	12	20	10	18	24	16	4	14	4	0	22	26	17	5	32	11	4	32	38	34	46	29	18	26	32	12		26	16.7
Jefferson	1	6	8	15	30	15	25	25	24	21	18	8	2	22	30	12	19	25	25	18	35	40	38	46	24	24	28	32	22	15	18	21.7
Keokuk	2	15	10	19	34	16	28	42	31	15	34	10	13	28	46	22	16	34	24	25	46	54	59	58	33	26	34	44	26	22	32	29.0
Keosauqua	7	14	10	14	30	14	18	34	28	16	32	15	10	28	42	22	17	30	27	25	40	50	46	55	41	26	33	40	26	20	32	27.1
La Crosse (Wis)	-5	2	6	10	17	10	13	27	30	9	11	-2	0	18	33	18	7	24	9	12	34	40	38	46	30	25	33	30	14	10	28	18.0
Larrabee	-4	4	2	19	24	24	22	26	18	6	12	-4	4	22	28	14	10	26	12	19	26	38	32	40	20	14	24	24	8	10	27	17.4
Logan	0	12	8	22	31	28	32	24	30	22	19	-2	10	29	26	18	28	32	20	22	31	36	44	50	10	22	21	23	10	22	32	23.5
Maquoketa	0	9	9	21	20	17	28	20	20	14	34	-3	12	32	36	24	11	24	27		38	45	50	30	29	20	29	32	22	22	32	23.6
Maxon	4	8	0	25	24	7	31	32	30	9	22	0	12	32	38	26	13	31	15	27	44	51	44	50	18	25	36	32	19	18	28	23.4
Mechanicsville	-2	7	6	17	27	10	20	26	30	7	24	-2	1	28	36	17	6	26	14	17	35	44	38	49	28	26	30	32	21	18	27	21.2
Monticello	-6	6	2	17	18	8	20	24	24	7	24	-8	2	28	36	18	4	24	11	13	32	41	34	47	30	25	34	32	20	16	28	19.9
Mt. Vernon	0	8	2	20	18	9	26	30	19	11	22	-6	12	32	37	18	11	22	10	22	40	45	47	55	25	25	34	31	20	18	29	22.4
Mt. Ayr	6	10	10	18											32	19	18	37	24	26	48	52	47	55	34	28	30	37	25	16	32	28.9
Newton	2	6	4	12	24	10	22	22	22	6	18	7	5	24	34	16	14	27	17	18	38	45	38	52	36	21	30	35	19	16	32	21.4
Omaha (Neb)	4	14	8	28	31	22	31	36	32	18	20	3	12	30	26	25	28	36	24	30	44	48	46	50	19	27	36	32	24	16	36	27.0
Osage	-8	3	3	15	13	12	20	24	24	6	13	-10	-2	25	29	12	4	18	8	12	36	37	32	48	24	24	28	32	20	14	28	16.1
Oskaloosa	2	11	4	12	26	12	16	26	24	9	25	10	10	28	34	20	16	31	21	23	41	50	42	54	34	24	31	37	23	18	30	25.9
Ovid	2	14	6	16	26	14	21	32	22	12	28	8	12	30	34	20	14	33	22	25	42	53	46	55	32	26	32	36	26	20	30	25.2
Panama	-2	10	6	20	28	16	24	28	17	12	16	4	10	27	32	18	18	30	20	26	34	34	40	49	26	22	32	32	19	16	30	22.1
Richland	4	9	1	22	16	6	26	30	17	10	23	-1	13	34	30	14	12	26	16	26	40	46	49	52	22	22	32	34	18	20	32	22.4
Rock Rapids	0	5	8	24	20	19	24	15	13	18	15	2	6	24	32	18	19	14	12	16	28	30	32	38	12	16	26	32	18	20	28	17.7
Sioux City	1	9	6	26	28	18	26	28	16	12	15	-1	8	24	28	20	16	32	18	24	36	42	38	46	10	20	28	32	16	16	30	20.0
Sac City	-1	4	4	24	16	16	22	25	15	8	16	-4	4	28	26	14	12	13	13	22	28	36	48	48	12	18	34	32	13	16	30	18.7
Seymour	14	14	14	15	24	13	32	29	35	29	32	2	2	30	36	18	30	20	22	22	42	48	48	49	26	25	42	30	26	45	45	27.6
Spirit Lake	4	5	4	16		16	23	28	24	8	14	14	3	20	26	16	14	25	20	18	31	34	34	40	22	15	26	28	13	15	33	18.6
Sibley	-6	12	1	20	26	15	18	26	20	2	8	-4	2	18	30	15	8	26	16	14	25	32	32	34	20	17	24	28	12	8	22	16.2
Tipton	2	6	7	14	24	12	17	28	24	10	26	6	5	30	40	32	10	27	15	20	32	50	42	52	38	24	29	35	24	20	30	23.6
Villisca	14	10	6	24	23	20	27	33	20	18	18	12	16	36	24	20	19	32	18	26	45	41	45	38	20	25	31	19	22	16	31	24.2
Vinton	1	8	2	21	15	11	26	24	18	10	18	-4	3	31	32	18	11	21	12	23	39	41	42	50	26	24	36	32	18	18	29	21.0
Washington	4	13	12	25	28	11	40	32	25	14	28	2	14	38	38	21	13	30	19	27	40	47	46	54	26	24	30	33	20	18	31	25.9
Webster City	4	10	4	28	15	20	32	32	16	11	14	4	13	30	18	13	19	22	12	24	35	38	40	48	20	22	28	32	12	17	32	21.0
West Bend	-4	7	3	28	10	16	25	27	9	6	11	8	8	27	26	12	13	22	8	24	34	34	34	39	9	20	28	29	20	6	16	16.0
Williams	1	5	1	25	14	14	20	31	13	7	14	-2	8	28	31	15	10	20	8	24	33	34	40	46	14	22	30	24	14	15	26	18.3
Winterset	0	8	3	16	25	11	31	18	10	4	15	1	10	31	18	14	35	23	42	52	36	42	48	20	25	31	33	21	17	26	25.0

STATIONS.	DATE.																																								Total.
	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th	27th.	28th.	29th.	30th.	31st.	
Algona	0.10	...	...	...	...	0 05	T	T	T	...	0.20	...	...	...	0.05	...	...	...	T	...	...	T	...	1.10	0.10	...	T	...	...	T	...	1.60
Ames (Hellman)	0.04	0.30	...	...	...	0.06	...	0.07	...	0.04	...	...	...	...	0.25	...	...	...	...	...	...	...	...	0.53	...	...	0.06	...	...	...	...	1.25
Ames (Young)	...	0.30	...	...	...	0.20	...	...	...	0.05	...	...	...	0.02	T	...	...	...	...	...	...	...	...	0.35	T	...	0.03	...	...	...	...	1.05
Ames	...	0.30	...	...	...	.07	...	...	0.10	0.04	...	...	...	0.09	...	...	...	...	...	...	...	...	...	0.56	0.06	...	0.06	...	...	...	...	1.28
Amana	...	0.42	...	...	...	0.05	...	0.06	...	...	0.02	...	...	...	0.17	T	...	...	...	...	...	...	...	...	0.45	...	...	0.05	...	T	...	1.22
Atlantic	...	0.60	...	...	...	...	...	0.50	...	0.05	...	...	...	...	0.20	...	...	...	...	...	...	...	...	0.55	T	...	...	...	0.05	...	...	1.95
Audubon	0.60	...	...	...	...	...	...	...	...	...	...	...	...	...	0.20	...	...	...	...	...	...	...	...	0.55	0.20	...	...	...	...	...	...	1.55
Belle Plaine	...	0.60	...	...	...	0.10	0.20	...	...	T	...	...	...	T	0.14	...	...	T	T	...	...	...	0.02	0.04	...	...	0.07	...	...	...	...	1.17
Bonaparte	...	0.60	...	...	...	...	...	...	...	0.10	...	...	...	...	0.13	...	...	...	...	...	...	...	...	0.27	...	...	0.07	...	...	...	...	1.17
Carroll	...	0.60	...	...	...	0.24	...	0.02	0.06	0.15	...	...	...	T	T	...	...	T	...	...	...	...	...	0.18	0.07	...	...	0.05	...	...	...	1.37
Cedar Rapids	1.48	0.22	0.25	...	...	T	0 10	0.16	T	...	0.04	...	...	...	0.21	0.13	T	...	...	T	...	...	...	T	0.70	T	...	0.11	...	T	...	2.40
Centerville	...	1.20	...	...	...	T	...	...	...	0.30	...	...	...	...	1.30	...	...	...	...	...	...	...	...	T	...	...	...	...	...	T	...	2.80
Charles City	...	...	...	...	...	0.30	.10	...	...	0.11	0.20	...	...	...	...	...	...	...	...	...	...	...	...	0.93	0.05	...	0.07	...	...	...	...	1.76
Clarinda	...	0.30	...	...	...	...	0.07	T	...	0.02	...	...	...	...	0.17	...	...	...	...	...	...	...	...	0.20	T	...	...	...	...	...	...	0.76
College Springs	...	0.40	...	...	...	...	0 08	...	...	...	...	...	...	...	0.30	...	...	...	...	...	...	...	0.21	...	...	...	...	...	...	...	...	0.99
Corning	...	...	...	...	...	...	0.07	...	0.06	0.05	...	...	...	T	0 30	...	...	...	...	...	...	...	...	0.34	...	...	T	...	...	...	...	0.82
Cresco	0.05	...	T	T	...	T	0.06	...	0.03	0.15	...	...	...	...	0.12	T	...	...	T	...	...	...	...	0.53	0.14	...	0.09	...	...	T	...	1.17
Davenport	...	0.46	0.04	...	...	.07	T	0.02	0.03	0.01	0.02	...	...	0.03	0.38	0.11	0.02	...	T	...	...	...	T	0.02	0.32	T	0.05	0.09	...	T	...	1.67
Decorah	...	0.02	...	...	...	0.02	T	...	0.02	0.28	...	...	...	0.47	0.21	0.01	...	...	...	...	...	...	0.08	0.53	0.03	...	0.06	...	...	...	...	1.73
Delaware	...	0.06	0.08	0.01	...	0.01	0.04	...	...	...	0.04	...	...	0.01	0.21	...	...	...	...	...	...	...	0.15	...	...	...	0.08	...	...	...	...	1.44
Denison	T	0.25	...	...	...	0.15	...	...	...	0.10	...	...	...	T	0.05	...	...	...	...	...	...	...	...	T	0.05	...	...	...	...	...	...	0.60
Des Moines	T	0.64	...	T	...	0.06	0.02	...	0.05	0.06	T	...	T	0.01	0.13	0.07	T	T	T	...	...	...	T	0.18	0.02	...	0.05	0.01	T	T	...	1.30
Des Moines (5½ miles se of)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.01	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1.33
Dubuque	...	0.13	...	...	T	0.02	0.12	T	0.02	...	0.21	...	...	0.01	0.57	0.07	...	...	T	...	...	...	...	0.12	T	...	...	0.04	...	0.01	...	1.85
Elkader	...	0.08	...	0.03	...	0.02	0.04	...	0.04	T	0.15	...	...	...	1.00	0.02	...	...	...	...	...	...	0.06	0.34	T	...	0.09	...	...	...	...	1.51
Ft. Madison	...	0.75	...	...	...	T	T	...	...	0.05	...	...	...	...	0.41	0.05	...	...	...	...	...	...	...	T	0.40	...	0.25	...	...	...	...	1.54
Galva	T	T	T	...	...	0.23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.41	...	...	...	0.50	...	...	...	0.47
Glenwood	...	...	0.30	...	...	...	...	...	...	...	...	...	...	...	0.15	...	...	...	...	...	...	...	...	...	0.50	...	...	0.02	...	...	...	1.86
Grand Meadow	...	0 06	...	0.03	...	0.04	...	T	0.06	T	0.20	...	...	T	0.67	T	...	...	T	...	...	...	...	0.15	...	...	...	0.15	...	...	...	1.86
Greenfield	...	0.81	...	...	...	0.05	0 02	0 21	0.01	0 05	T	...	...	0.04	0.22	...	...	...	...	...	...	...	T	...	...	...	0.04	...	0.01	...	...	...
Grinnell	0.39	...	T	...	0.06	0.15	...	T	0.04	T	...	...	...	0.10	0.70	...	...	...	...	...	...	...	T	0.30	...	T	...	0.50	0.01	...	...	2.62
Grundy Center	0.10	0.10	...	T	...	0.05	...	...	0.03	0.02	...	...	...	0.27	0 03	...	...	T	...	...	...	...	0.13	0.68	T	...	0.08	...	...	...	...	0.98
Hampton	0.02	0.07	...	T	...	0.01	...	0.09	0 05	...	0 13	...	...	...	0 42	...	...	...	T	...	...	...	0.02	0.12	T	...	0.07	...	0 05	...	...	1.36
Hopeville	T	0.16	...	T	...	0.01	T	T	0.01	0.03	...	...	...	...	0.16	...	...	...	T	...	...	...	T	0.48	T	...	...	T	T	...	...	0.53
Hopkinton	...	0.30	...	...	...	...	0.20	...	...	...	0.10	...	...	...	1.00	0.10	...	...	...	...	...	...	...	0.16	...	...	0.28	...	...	...	...	1.20
Humboldt	...	...	0.42	...	...	...	...	...	...	...	...	...	0.10	...	...	...	...	...	...	...	...	...	...	0.22	...	...	0.05	...	...	...	...	2.02
Independence	...	0.35	...	T	...	0.10	T	...	0.10	...	0.05	...	...	T	T	...	...	...	T	...	...	...	...	0.45	T	...	T	T	...	...	...	0.70
Indianola	0.56	...	T	...	...	0.05	0.20	...	T	0.08	T	...	...	T	0.05	0.04	...	...	...	...	...	...	T	0 10	...	...	...	...	T	...	...	1.10
Iowa City	...	0.80	...	...	...	0.10	...	...	...	0.05	...	...	...	0.25	0.20	...	...	...	...	...	...	...	...	0.10	T	...	0.12	...	...	T	...	1.52
Iowa Falls	0.04	0.30	...	...	...	...	...	...	T	...	T	...	...	...	0.05	...	...	...	...	...	...	...	T	...	0.10	...	0.05	...	...	...	...	1.50
Keokuk	...	0.28	0.10	...	...	0.01	...	...	...	0.12	...	...	...	0.03	0.19	0.02	...	...	T	...	...	...	...	0.96	0.07	...	0.05	0.03	...	T	...	0.90
Keosauqua	...	0.13	...	...	...	0.04	T	T	T	0.03	...	...	T	T	0.06	0.04	...	...	T	...	...	...	...	T	0.47	...	T	0.03	...	T	...	0.80
La Crosse (Wis)	...	0.02	T	T	...	T	0.06	...	0.12	...	0.32	...	0.04	...	0.49	0.06	T	...	T	...	...	...	...	T	0.40	...	...	0.10	...	T	T	2.03
Larrabee	T	T	...	T	...	0.10	...	T	0.04	0.08	T	...	...	0.05	0.05	...	...	...	...	...	...	...	T	0.42	0.22	...	T	...	T	...	T	2.27
Le Claire	0.02	0.52	...	...	...	0.02	...	0.07	...	...	...	...	...	0.32	0.31	0.02	...	...	...	...	...	...	...	1.67	...	...	...	...	0.06	...	...	1.40
Logan	...	0.47	...	...	...	...	...	...	...	0.02	...	...	...	...	0 01	...	...	...	...	...	...	...	0.61	0 12	0.11	...	...	...	...	...	...	1.22
Maquoketa	...	0 28	...	...	...	0.07	0.05	...	0.05	...	...	...	...	...	0.55	...	0.02	...	...	...	...	...	...	...	0 08	...	...	...	T	...	...	1.10
Maxon	T	0.50	...	T	...	0.08	0.02	...	T	0.10	...	...	...	T	0.30	0.15	...	...	...	...	...	...	...	T	0.20	...	T	T	...	...	...	1.25
Mechanicsville	...	0.30	...	...	...	0.06	0.04	...	0.01	...	...	...	...	0.02	0.10	0.02	...	...	...	...	...	...	T	...	...	...	0.15	...	...	0.03	...	0.73
Monticello	...	0.20	...	...	...	0.05	0.15	...	...	...	0.03	...	...	T	0.53	0.02	...	...	...	...	...	...	0.02	0 42	...	...	0.09	...	...	...	...	1.54
Mt. Ayr	...	0.26	...	...	...	...	0.10	...	...	T	...	...	...	T	0.07	...	...	...	T	...	...	...	T	0.13	...	...	T	...	...	...	...	0.59
Newton	...	0.46	...	...	...	0.09	0.10	...	...	0.05	...	...	...	T	0.13	...	...	...	...	...	...	...	T	0.20	...	...	0.08	...	...	...	...	1.11
Omaha (Neb)	T	0.43	T	T	...	0.01	T	T	...	0.02	T	...	...	T	0.12	...	...	...	...	...	...	0.03	T	0.48	0.01	...	0.03	...	T	T	...	1.13
Osage	0.30	...	...	...	...	...	...	0.10	...	...	0.20	...	...	...	0.30	...	...	...	...	...	...	...	...	0 50	...	...	0.25	...	...	...	...	1.65
Oskaloosa	...	0.50	...	...	...	0.06	T	...	...	0.05	...	...	...	...	0.23	...	...	...	...	...	...	...	...	0.08	...	...	T	...	0.01	...	...	0.93
Ovid	...	0.52	...	...	...	T	0.07	...	T	0.10	...	...	...	...	0.15	...	...	...	...	...	...	...	...	0.30	T	...	T	0.07	...	...	...	1.22
Panama	...	0.38	...	...	0.02	...	...	...	0.02	...	...	...	...	...	...	0.07	...	...	...	...	...	...	...	0.65	0.03	...	...	...	0.09	...	...	1.26
Richland	...	0.55	...	...	...	T	T	...	...	0.03	...	...	...	0.28	0.29	...	...	...	T	...	...	...	...	0.06	T	...	0.08	...	...	T	...	1.29
Rockwell City	T	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.66	...	...	0.02	...	...	...	...	0.68
Rock Rapids	...	...	...	...	T	0.10	0.05	0.10	T	0.05	...	...	...	...	...	...	...	...	...	...	...	...	0.25	0 30	0.10	...	...	T	T	T	...	1.15
Sac City	...	0.20	...	...	...	...	...	...	...	...	0.20	0 40	...	...	0.50	...	...	...	...	...	...	...	0.25	0.50	0 10	...	0.10	...	...	...	...	1.65
Seymour	...	0.20	0.50	...	...	...	...	...	...	...	...	...	...	...	0.15	...	...	...	...	...	...	...	...	0.22	T	...	T	...	T	T	...	1.67
Sibley	...	T	...	T	...	0.01	...	...	0.08	T	...	...	...	...	T	...	...	...	...	...	...	...	...	0.37	0.37	...	T	...	T	...	...	1.43
Sioux City	T	0 20	...	T	...	0.07	...	...	T	0.01	T	...	...	T	T	...	...	T	T	...	...	...	T	0.89	0.25	...	0.01	T	0.14	T	...	1.57
Storm Lake	T	...	...	...	...	0.10	...	...	0.08	...	...	...	...	...	...	0.08	...	...	...	...	...	...	...	1.02	0.12	...	...	0.01	...	0.05	...	1.46
Tipton	...	0.96	...	...	...	0.04	0 02	...	...	T	...	...	...	...	T	T	T	...	...	...	...	...	...	0.12	T	...	0.22	...	...	0.03	...	1.39
Villisca	...	0.25	...	...	...	...	...	0.15	...	...	...	...	...	...	0 05	...	...	...	...	...	...	...	0.08	...	...	...	...	...	...	...	...	0.46
Vinton	...	0.30	...	...	...	T	...	T	...	...	0.10	...	...	...	0.10	T	...	...	T	...	...	...	...	0.06	T	...	0.08	...	...	...	...	0.64
Washington	...	0.60	...	...	...	0.06	T	...	...	0.07	...	...	...	T	0.24	0.09	...	...	...	...	...	...	...	0.08	...	...	T	...	...	T	...	1.14
Webster City	...	0.40	...	T	...	T	...	...	0.12	T	...	...	...	...	0.12	...	...	...	T	...	...	...	...	...	0.40	...	T	...	...	...	...	1.04
West Bend	0.10	T	...	...	...	...	...	...	...	...	...	...	...	0.18	T	...	...	...	...	...	...	...	...	0.78	0.20	...	...	...	...	T	...	1.26
Williams	...	0.09	...	0.05	...	0.02	...	...	0.20	...	0.04	...	...	...	...	0.04	...	...	T	...	...	...	...	0.45	0.01	...	0.05	...	0.01	T	T	0.96
Winterset	T	1.00	...	...	...	0.15	T	0.10	...	...	...	...	...	...	T	...	...	...	...	...	...	...	...	...	T	...	T	...	T	...	...	1.25

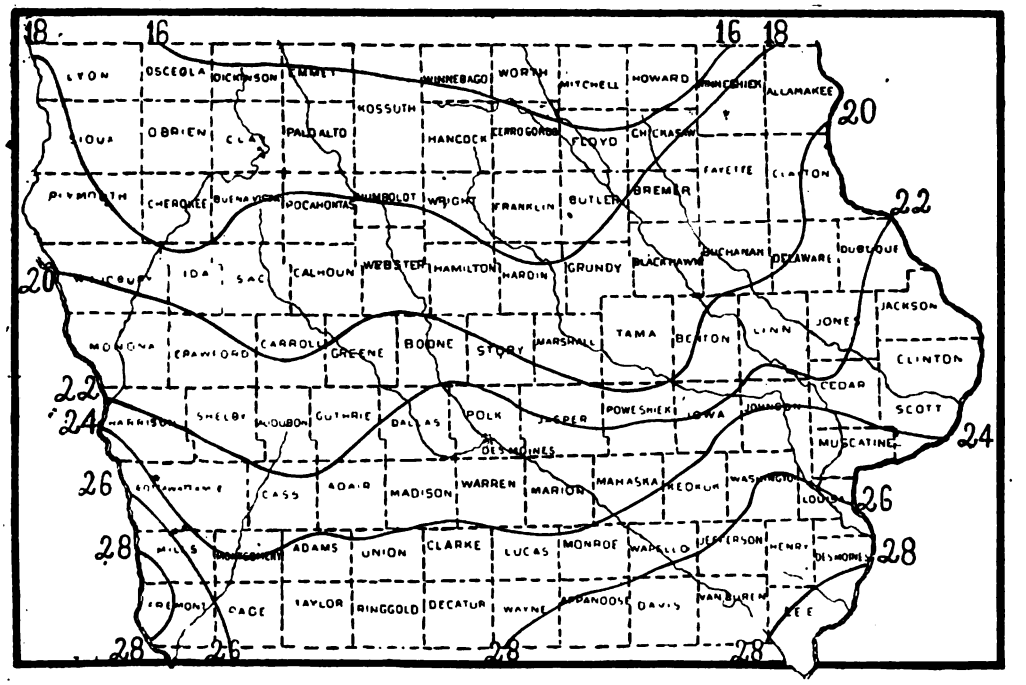
MAXIMUM AND MINIMUM TEMPERATURE FOR DECEMBER, 1893.

| STATIONS. | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | | 9 | | 10 | | 11 | | 12 | | 13 | | 14 | | 15 | | 16 | | 17 | | 18 | | 19 | | 20 | | 21 | | 22 | | 23 | | 24 | | 25 | | 26 | | 27 | | 28 | | 29 | | 30 | | 31 | | Mon'y Mean. | |
|---|---|---

IOWA PRECIPITATION CHART DEC. 1893.



MEAN TEMPERATURE DEC. 1893.



METEOROLOGICAL STATIONS AND OBSERVERS.

From the following, weekly and monthly reports of Meteorological data are received by the Iowa Weather and Crop Service.

Albia	Gus Johnson.
Algona	
Alta	C. D. Pettibone.
Amana	D. E. Hadden.
Ames	Conrad Schadt.
Ames	E. C. Dickinson.
Ames, (4 miles S. W.)	J. Edgarton.
Atlantic	Isaac Young
Audubon	J. W. Love.
Belle Plaine	J. F. Hocker.
Blakeville	H. W. Vandike.
Blockton	James Rodgers.
Bonaparte	C. W. Thompson.
Carroll	Hon. B. R. Vale.
Cedar Falls	Moses Simon.
Cedar Rapids	Prof. A. C. Page.
Centerville	H. D. Olds.
Charles City	Prof. H. E. Reister.
Clarinda	J. W. Smith.
Clinton	A. S. Van Sandt.
College Springs	Luke Roberts.
Corning	A. A. Berry.
Cresco	John W. Bixby.
Council Bluffs	Gregory Marshall.
Davenport	E. W. Hart.
Delaware	*F. J. Walz.
Decorah	Wm. Ball.
Denison	L. H. Baker.
Des Moines	P. H. Schlumberger.
Dubuque	*Geo. M. Chappel, M. D.
Eagle Grove	*S. C. Emery.
Eldora	C. A. Schaffter.
Elkader	Prof. C. F. Woodward.
Emmetsburg	Chas. Reinecke.
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UNITED STATES DEPARTMENT OF AGRICULTURE
WEATHER BUREAU.

MONTHLY REVIEW

OF THE

Iowa Weather and Crop Service.

VOL. V.—JANUARY, 1894.—NO. 1.

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LOCAL FORECAST OFFICIAL,
U. S. WEATHER BUREAU, ASS'T DIRECTOR.

DES MOINES:
G. H. RAGSDALE, STATE PRINTER.
1894.

THE IOWA WEATHER AND CROP SERVICE

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U. S. Department of Agriculture---Weather Bureau.

MONTHLY REVIEW

OF THE

IOWA WEATHER AND CROP SERVICE.

VOL. V.] JANUARY, 1894. [NO. 1.

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EDITORIAL NOTES.

Nitrogen is a prominent and important constituent of all plants. The nutritive value of all animal and vegetable foods depends largely upon the organic combinations of nitrogen contained therein. The nitrogenous or albuminoid constituents of foods are essential to the formation of muscle, tendon and ligaments of all animals.

Nitrogen in the free or gaseous state constitutes about one-fifth of the atmosphere, but notwithstanding its abundance in nature, it is the most rare and costly ingredient of the soil in the form adapted to the use of plants. The nitrogen of soils is derived from the residues of former animal and vegetable life, from the fixation of free nitrogen by organisms of the soil, and from nitrogenous compounds absorbed by the soil from the air, or washed down by rain and snow. Observations at Rothamsted show that the average annual quantity of nitrogen brought down in rain and snow amounted to 3.37 pounds per acre. This is relatively small compared with the amount received by absorption and by certain organisms. The chief value of the clovers is in the fact that they serve largely to increase the quantity of nitrogen in the soil.

***

Wild geese were observed flying northward on January 18th. This fact was regarded by some people as an indication of an early spring; but in all probability those geese soon found that they had been misled by a silly and conceited old gander. The average goose, whether tame or wild, doesn't know any more about the future weather than—well, than our so-called planetary weather prophets.

***

The backbone of winter was broken by a thaw about the middle of January, but the severed parts were re-united and the boreal spinal column became firmer than ever before the month ended.

***

Prof. Budd, who is a close observer of the weather, as well as of everything else for that matter, says that the storm of Tuesday is of a variety that does not occur twice in twenty-five years. Mercury stood at about six below when it began to snow, and descended steadily with the wind in the northwest, while the snow continued to fall. Ordinarily it does not turn cold until after the storm is over, but in this case it did.—*Ames Times.*

***

The month of January was well named, judging by the sample furnished in 1894. It was literally Janus-faced, the one side blowing hot and the other cold—spring-like zephyrs closely followed by boreal blasts. But withal it was a pleasant and generally favorable month for this latitude and longitude.

***

On the morning of January 25, zero temperature covered nearly one-half of the total area of the United States exclusive of Alaska.

***

It has been ascertained by a series of experiments that rye and winter wheat germinate at 32 degrees; barley, oats, flax, clover and the pea at 35, Indian corn at 48, turnips at 32, carrots at 38, and beans at 40. By adding 12 degrees to each of these, the best normal temperature of germination is obtained.

***

Editor Geo. E. Hunt of the Nebraska Weather Record, says: "The Secretary of Agriculture in a recent conversation with the writer expressed a very high opinion of the men of the United States Weather Bureau, saying that considering their long hours of duty, which embrace Sundays and holidays, and the responsibilities devolving upon them, that they are a poorly paid body of men as compared with other Government employes. He was especially pleased that nine out of the ten best essays upon meteorological subjects prepared in connection with the recent examination for a professorship in the Weather Bureau, were submitted by forecast officials, observers and assistant observers of the service.

***

The Denision *Review* states that during the cold spell in January the water in a bucket at the bottom of a well twenty-two feet deep, was covered with ice half an inch in thickness. The well was on the farm of J. G. Vassar,

of Crawford county, and on the morning when the ice was observed the mercury was 26° below zero. At that time the barometer was unusually high, and the freezing at that depth was caused by the excessive atmospheric pressure.

***

The tornado season opened earlier than usual this year in the south. On February 3d a small one visited a few localities in southern Alabama causing considerable damage. On the evening of February 8th a tornado devasted the country within a narrow strip through northwestern Mississippi, inflicting severe damage and resulting in loss of life.

***

"The Story of a Storm" is the title of a well written and profusely illustrated book of 228 pages, recently published by F. W. Sprague, of Lake City. It gives a graphic history of the tornado at Pomeroy, on the evening of July 6, 1893, with a narrative of the thrilling incidents, personal experiences and fearful disasters of that most destructive storm that ever visited Iowa. The book will doubtless have an extensive circulation.

PRACTICAL VALUE OF AGRICULTURAL STATISTICS.

The following extracts are clipped from an article by Hon. J. R. Dodge, late statistican of the U. S. Department of Agriculture, published in the *Inter-Ocean*, February 3d. It contains some valuable points for the consideration of Iowa farmers:

The farmer is dependent upon statistics to know what and how much to plant, when to market, and how long to hold his products, and what prices he may reasonably expect. The dealer feels a similar dependence for a knowledge of when to buy and when to sell, and the chances of a reasonable profit on his ventures. The consumer should know the relative abundance and scarcity of products, as a means of protection against the imposition of the greedy huckster or purveyor. The statesman acknowledges a daily dependence on statistics as a basis of legislation. There is much of ignorance yet among those and all other classes upon a subject of universal necessity and prime importance.

It is the province of agricultural statistics to survey and classify our lands and show their productive capacity; to contrast the results of inferior and superior cultivation; to weigh the effect of overproduction in the decrease of values; to prove the folly of dependence upon distant and uncertain markets for bulky primary products; to show the correlation of the industries and the benefit of increasing numbers of consumers to the prices and profits of agriculture; and to indicate the advances of science in their application to farm industry to aid the cultivator in keeping pace with such progress.

Among the more thoughtful and intelligent there is no lack of acknowledged appreciation of this subject, and great activity of statistical inquiry, too often combined with impatience of investigation, frequently with flippancy of statement, and not unfrequently with carelessness of accuracy and thoroughness. There is a feverish desire to take a census of a continent in a day and publish its results the next. There is too much generalization from uncertain data. Weighty conclusions are made to rest on few and scattered facts. To weigh and sift them and reach warranted and philosophical conclusions requires too much time and effort. There should be less precipitancy and more industry, less flurry and more thought, less zeal without knowledge and sounder judgment. Few have learned the logic of statistics, and many of our law-givers, as a confession of inexperience, are accustomed to build by proxy the framework of their political economy, and are liable to give it a fantastic and incongruous finish.

Legitimate deductions from agricultural statistics reveal many a popular error or shortcoming in agricultural practice. A prevailing practice may have an obvious and specious reason, but it fails to prove that "whatever is is right." If expedient once circumstances may have made it impracticable and improper. A farmer may fail to do what he knows is best because custom has made easy what has become habitual. If man is a creature of habit, perhaps no one is more subservient to the will of his creator than the average farmer.

RURAL LESSONS TAUGHT BY STATISTICS.

A lesson of universal application is deduced from the records of rate of yield in this and other countries. They show the yield of England more than three times that of Russia, and that of Illinois more than twice that of Georgia, while, strange to say, that of New Hampshire is greater than that of Illinois. So it is with all sorts of crops, with the milk yield of cows and with the butter yield of milk. It means not that the difference in crop reduction is that of natural fertility, for often the more fertile sections produce less than others far less fertile naturally. In stock it is a difference in breed and management; in crops it is a difference in cultivation, fertilization and rotation. Crudity and carelessness, lack of labor and absence of skill have much to do in reducing yields. Similar differences exist in smaller districts in every county, township, neighborhood. More careful scrutiny and closer analysis of such facts will reveal the causes of such variation, and ordinary practical intelligence will suggest remedies.

The sectional error of the east is beginning to be seen by the light of statistics. It is the common one of conservatism that will not change crops or methods with changing circumstances. The farmers' sons have left the hard and rocky soils for the workshop or factory, for a trade, or a profession, or a western farm; the old man has sent his surplus earnings to the savings bank or to Kansas on a loan at 10 per cent, and now, with health and strength declining, crops, and herds, and flocks decreasing, he reaches the unwelcome conclusion that "farming doesn't pay." A progressive neighbor in the meantime realizing the competitive effect of railroad extension and the ruinously cheap "long haul," has gone into small fruits, set out an orchard, planted a cranberry bog, covered an acre or two with glass for growing vegetables,

and realized more from a patch than the old farmer does from his broad acres. Or he establishes a milk route, builds a creamery, runs a dairy and piggery, and produces whipped cream and fancy sausages and breakfast bacon—does something in better style and business methods than has been done by his neighbors, and makes money in spite of the west and its competition, simply because he employs the logic of facts, improves the opportunities which are thrust upon him by the proximity of large populations, and the high prices willingly paid for freshness and superiority in quality and neatness of package. The receipt of $600 for an acre of cranberries, as much for the results of modern market gardening, and a handsome sum for orchard or small fruits, tends to content and cheerfulness, and has been known to draw from the west returning wanderers, or the migration to the seacoast of strangers to these rocky soils.

The south has been taught a lesson by that harsh master, bitter experience, which has been emphasized by the facts of declining prices that over-production of one staple is a waste of labor, and the neglect of other needed products consumes the diminished proceeds of that single crop. In every neighborhood there are available statistics of thrift and accumulation from mixed planting, the growth of all necessary crops required for farm supplies, with cotton as a surplus crop. In many such a district the majority still plant little but cotton and grumble loudly at its failure to "pay." No agricultural conservatism in the United States has been so persistent and unchanging as this domination of King Cotton, or so ruinous to rural prosperity. The crop itself has been munificent in its opulence, but the dwarfing of everything else has borne bitter fruits in the past, and remedial influences are yet slow of operation.

The west has learned much from statistics and has much yet to learn. Following the bad example of the south, she undertook to organize a principality as a sovereignty of wheat, dependent mainly on the patronage of a single diminutive island lying on the borders of the North Sea, dreaming of its single market as magnified into "the markets of the world." And then this principality, whose inhabitants were nearly all farmers, attracted and imported from the further shore of the North Sea farmers enough to grow more wheat than we can possibly sell to the outside world. All excellent people, but they would be happier and richer if their business was something other than wheat growing, and better still if in some production outside of agriculture.

STATISTICAL EVOLUTION.

The rise of agricultural statistics is recorded practically in the history of a half century. Its largest development has been included in the last two decades. There are still many states in this country and many governments of foreign countries that do nothing in the collection of agricultural statistics. There is a great accession of experience in handling statistics in recent years, yet there are still incompetents in statistical positions, but the great bar to accuracy and utility is found in lack of popular appreciation of the material importance of the subject, and in the opposition of many to publicity of data necessary to secure to producer and consumer fair prices and freedom from imposition. What is needed is education of the masses to insure intelligent and accurate returns, and the disposition to make public such information. An amount of judgment and facility of mental calculation that is not possessed by every one is essential to best accuracy and highest utility. The investigator is himself often at fault in making inquiries that are impracticable or beyond the ability of the average correspondent to answer. This has probably been the case more frequently in ambitious census schedules than in any other official statistical investigation.

One hindrance to perfecting of statistical accuracy is found in innate selfishness of certain dealers in agricultural products. There are many in Chicago, some of them high on the rolls of the Board of Trade, who discourage general effort toward popular enlightenment on this subject, who deprecate publicity, prefer to keep farmers especially in the dark, while admitting that they are willing to spend thousands for exclusive information. The writer has heretofore received precisely such admissions from this class of dark-lantern investigators. Of course it is understood that a sharp business man will look out for himself, but he can do this without opposing the necessary and legitimate extension of practical education, prejudicing farmers by misleading and false statements, misrepresenting reliable statistical results for his own advantage, or doing any other disreputable or dishonorable act. The great majority of Chicago business men, so far as appears, are not amenable to this criticism, but there are black sheep in every flock, and it is possible that some of them may be bell-wethers. It is believed that as a rule they are high-minded, honorable men with progressive ideas consistent with a broad humanity, even a generous public philanthropy and desire for the general good and public welfare.

Let all such, with representatives of all classes, and especially farmers, who have more to gain than most others by statistical education and publicity of results, unite to enact and enforce local statistical systems and secure a basis of statistical comparisons that shall promptly and accurately note the frequent changes that are occurring in the area and product of crops and in the numbers and conditions of farm animals.

CORN GROWING IN NORTHWESTERN IOWA.

Mr. P. R. Bailey, of Primghar, O'Brien county, contributed a valuable paper on the above topic, which was read at the recent session of the Iowa Producers Association, January 10th and 11th. The following extracts are copied therefrom:

"It is only within recent years that the farmers in the extreme northwestern counties of Iowa have demonstrated that almost as good corn can be grown up here near the top of the map as can be raised in the central or southern counties. What is known as the "big four" counties—O'Brien, Sioux, Lyon and Osceola—have in recent years convinced the owners of the soil that corn is not only the

surest crop for the farmer to grow, but is also the most profitable. Corn with us can be grown with less risk, less expense, and at a greater net profit than any other crop, except perhaps flax, the production of which is fast decreasing as the land grows older.

Without entering upon a discussion as to the cost of producing any of our small grain crops I will proceed to give an estimate of the cost of producing an acre of corn in this latitude, which must vary more or less according to the amount of cultivation given the crop. The figures given below are based upon information obtained from the most progressive and intelligent farmers in the "big four" counties.

It will be noticed that the first item of cost is the rental value of the land, and the last item is the value of the stalks as pasture for stock. The average number of bushels grown here per acre may seem small, as some writers have placed the average yield in this section the past season at 47 bushels; but last year's corn crop was an exception, and more than the average. No allowance is made for fertilizing, as our farms have not yet reached the stage when it is absolutely necessary, though it may increase the yield when properly used.

COST OF PRODUCTION PER ACRE.

Rental value of land	$ 2.50
Plowing	1.00
Harrowing	.08
Seed and planting	.35
Harrowing after planting	.08
Plowing three times	1.05
Husking	1.00
Total cost	$ 6.06

VALUE OF CROP.

40 bushels per acre, worth	$10.00
Stalks for pasture	.25
Total	$10.25
Net profit	$ 4.19

The prices of seed and labor are such as usually obtain in this section. Of course it is universally conceded that when corn is fed to cattle and hogs there is a much greater profit than when it is sold on the market at the price above quoted—25 cents per bushel.

From the fact that the soil in the northwestern counties is dryer and can be worked earlier in the spring than land in the vicinity of Des Moines, it follows that what we lack in climatic conditions in early spring we make up in the more favorable condition of the soil for early planting. The northwest counties, and especially those bordering on the slope of the Big Sioux and the Missouri, will equal, if not excel, the southern portion of the State for corn production."

A special to *The Inter Ocean* from Huron, S. D., says: "The United States Weather Service has been of much value in this locality the present winter. Its warnings of approaching cold and storms have been sent out sufficiently early for stockmen to get their herds under shelter before storms came upon them. The establishment of volunteer signal stations in remote districts early in the fall has proven of vast benefit to ranchmen and settlers generally."

WHAT THE IOWA GEOLOGICAL SURVEY HAS BEEN DOING.

BY DR. CHARLES ROLLIN KEYES, ASSISTANT STATE GEOLOGIST.

In the forthcoming annual report, which will be issued shortly, the workings of the Geological Survey for the past year are fully set forth. It was through their representation at the last session of the General Assembly that the people of Iowa authorized a geological survey of the State. There probably never had been a period in Iowa's history when she had felt more the need of a thorough, economic investigation of her native wealth. The survey contemplated was not an investigation such as was vaguely conceived by many, but one broad in its scope and far-reaching in its work—one whose primary aim was to bring before the public the State's natural products, to encourage its material development and to invite the investment of outside capital. Long had it been a matter of general regret that a commonwealth so happily supplied with boundless natural riches should have no official information to which either her citizens or the public at large could turn.

The law establishing the Geological Survey provides for "A complete survey of the natural resources of the State in all their economic and scientific aspects; including the determination of the order, arrangement, dip and comparative magnitude of the various formations; the discovery and examination of all useful deposits, their richness in mineral contents, and their fossils; and the investigation of the position, formation and arrangement of the many different ores, coals, clays, building stones, glass sands, marls, peats, mineral oils, natural gas, mineral and artesian waters and such other mineral materials as may be useful, with particular regard to the value of said substances for commercial purposes and their accessibilities; also the careful noting of the characters of different soils and their capacities for agricultural purposes; the growth of timber and other scientific or natural history matters that may be of practical importance and interest." The law is liberal in its application, comprehensive in its requirements, practical in its hearings. Not the least valuable of its measures is the provision for the diffusion of useful knowledge among the citizens of the State. The demand for authoritative information of this kind has long been so prevalent that it was a matter of much surprise that steps in the proper direction had not been taken years ago. To be sure, such a movement had been twice started, and twice rendered ineffectual, first in the fifties and again more than a quarter of a century ago. Both attempts were hurried reconnaissances—one of the eastern half of the State, the other of the western portion. Being thus merely preliminary, the results were necessarily very incomplete. Moreover, during the past two decades much information concerning the mineral wealth of Iowa has accumulated and when brought together in a connected way with the results of other investigations it will be of the greates

value. In the same period geology itself has made gigantic strides, not only scientifically, but economically.

The great interest now shown in the examination of the natural resources of Iowa is not confined wholly to the people of the State. There are probably as many people living without the borders of Iowa as there are within them who are keeping themselves informed in regard to what is being done by the Survey. Indeed, the work has met with as universal favor and appreciation abroad as at home. As was well stated not long ago in one of the leading newspapers, Iowans are, as a general rule, too busily occupied with their own affairs to go much out of their way to get information in regard to that which does not connect itself directly with the advancement of their own material interests. The benefits of the Survey appear to some people to be only indirect; hence, there is often by these persons a lack of proper appreciation of the aims and ends of the work. As the real facts become known and the citizens become more and more acquainted with the doings of the Survey it is extremely rare that a warm interest is not manifested. This solicitude for the carrying out and completion of the investigations begun is not shown in Iowa alone. As the published reports are made accessible they are reviewed and talked about, more or less, in almost every country of the globe.

OBJECT OF THE GEOLOGICAL SURVEY.

When a merchant wishes to know exactly how his business stands he takes an inventory of his possessions. A state in establishing a geological survey, has also in mind an inventory of her possessions; that is, her mineral resources, her wealth inherited from Nature. These natural resources are found in the clays, coals, soils, metallic ores, mineral waters, building materials and other things which may be made to serve the purposes of man. But a geological survey is very much more than a simple inventory—a mere taking account of stock. It not only makes out a list of the various minerals, but locates the different substances, accurately investigates their qualities, extent and accessibility, notes carefully their particular uses and value and suggests improvements in the methods of obtaining and treating them for commercial purposes. In order that the information may be readily and accurately interpreted the determinations and facts are recorded and explained on suitable maps or in the descriptive notes which accompany them.

Among the general objects to be obtained for the State through the work of a complete geological survey may be mentioned:

First.—The provision of a suitable foundation for detailed and intelligent search for mineral wealth. One of the chief benefits resulting from this work is the limitation of different mineral bearing areas in which prospecting may be profitably undertaken. The necessity of this course has appeared all the more urgent as the work of the survey has progressed. It may be a matter of considerable surprise to learn that carefully made estimates show that more money has often been wasted in many counties in a single year in ill-advised and poorly conducted efforts to discover coal and other minerals than would annually support a well conducted and systematic investigation of the entire State. Numberless abandoned diggings are met with, most of which mark fruitless efforts to obtain minerals in places where success is as utterly hopeless as could be imagined. All this useless expenditure of capital and labor might have been largely avoided had some authoritative information concerning the geological features of the particular localities been accessible.

Second.—The assurance of permanency in the development of resources already known. Means will be provided beforehand by which without encountering repeated failures and inconveniences each one may know how to turn his discoveries to best account, how to work deposits to the best advantage and how to prepare the products in the most suitable manner for market. The properties of the different substances and the uses to which they may best be put having been determined practically the further advancement of the dependent industries is greatly simplified. On the completion of the work on any subject all the information possible is brought together, so that when a person engages in any mining enterprise or business connected with the natural resources of the State he will not fail to find in the particular report something which will greatly assist him in his efforts and prevent useless waste of time and money.

Third.—The establishment of an official guaranty respecting the natural wealth of the State. Information given by disinterested persons concerning the State's possessions is always regarded as more trustworthy than when imparted by private individuals. Citizens at home as well as abroad have confidence in making investments and feel that they are not entering into mere speculative fields.

Fourth.—The information on a scientific basis of a standard by which the geological features of the State may be compared with those of other districts. There is a wide demand for something of this kind for instruction in schools and colleges. The text-books commonly used consider only the principles of the science; the reports of the survey supplement this outline by giving detailed information of local application.

Fifth.—An advancement of the agricultural interests of the State. This is more fully considered elsewhere.

GENERAL PLAN.

The efforts of the geological survey are directed primarily to a consideration of the mineral resources of the State, from the standpoint of the utilitarian. In the progress of the work there come to be recognized two classes of operations; the one somewhat general in its character, the other more specific. The first may be called the subject work and the second the areal work. In the former it is designed to take up each particular topic, as coal, clay, building stone or soil, and to consider the deposits as a whole for the entire State. In contradistinction areal work has for its object the consideration of all useful mineral deposits of limited districts, as a

county or other convenient area, particular attention being given to local details. There are in addition to the two principal classes here mentioned two other lines of investigation which together might properly form a third class.

SUBJECT WORK.

Mineral deposits are not limited by modern political boundaries. Each kind of ore, clay, or other natural product dug from the earth belongs to some particular geological formation, that is, it is found at some horizon or level more plentiful than at others. Thus one formation is abundantly supplied with coal; another with ores of zinc or lead; a third with gypsum, or materials for the manufacture of cements; and others with still different substances of economic value. Each is found in a particular geological zone and rarely or very sparingly elsewhere. Only within certain districts would search for a given substance be successful; outside of these areas no amount of prospecting would ever disclose the material sought.

An investigation of any special mineral substance necessitates a careful consideration of the entire subject. At the outset a clear understanding of the geological structure of the rocks containing it is of prime importance. The localities where it occurs require description. The arrangement, relations and extent of the material must be defined; the origin and properties discussed; the extent, accessibility and value determined. The uses of the substances, the nature and status, both present and probable future, of the industries connected should be fully considered. A report on each special subject must therefore be comprehensive in character, and concise in statement. The work cannot be weighted down with all the details of only local interest, as this would extend the account far beyond the space that could be allotted to it. Information of an entirely local character may be recorded on maps or described in accounts of areas.

Subject work is thus quite prominent in dealing with all the useful material substances found in the State. It necessarily includes two classes; the principal topics which are the larger subjects, and requiring a very considerable time to finish, and subordinate subjects which comprise numerous minor themes. The former, of course, are taken up first. While they are being investigated, facts are continually accumulating in regard to the collateral subjects, which with a little special attention later will ultimately be brought together, forming valuable additions to what is already known concerning the resources of the State.

AREA WORK.

Areal work has for its object the consideration of the economic resources of particular districts as already explained. Its direct purpose is to satisfy constant and ever increasing demands for information in regard to given localities. The desire to know about the mineral products of each particular neighborhood is so general throughout the State that full details are required concerning every substance which is, or is likely to be, of value to the land owner or occupant of the territory. Probably one-half of the people of the State seek this local information.

PUBLICATION OF RESULTS.

One of the cardinal points in the investigation of the natural resources of the State is the placing of practical information in regard to the various deposits before the people as rapidly as possible and at the same time in a measureably complete form. It should be stated in this place what has been done towards placing the results of the work before the public. Two volumes of about 500 pages each have been made ready, and the third is in press, the contents of which are appended. They are sold according to law, at cost price of publication, the moneys accruing being turned into the State treasury.

VOLUME I. FIRST ANNUAL REPORT.

480 pages, 10 plates, 26 figures.

Contents:

Administrative Report of the State Geologist.
Administrative Report of the Assistant State Geologist.
Geological Formations of Iowa; by Charles Rollin Keyes.
Cretaceous Deposits of Woodbury and Plymouth Counties, with Observations on their Economic Uses; by Samuel Calvin.
Ancient Lava Flows in Northwestern Iowa; by Samuel W. Beyer.
Distribution and Relations of the St. Louis Limestone in Mahaska County, Iowa; by Harry Foster Bain.
Annotated Catalogue of Minerals by Charles Rollin Keyes.
Some Niagara Lime Burning Dolomites and Dolomite Building Stones of Iowa; by Gilbert L. Houser.
Bibliography of Iowa Geology; by Charles Rollin Keyes.

Price, in cloth, 85 cents, postage 31 cents; in paper, 70 cents, postage 26 cents.

VOLUME II. COAL DEPOSITS.

536 pages, 18 plates, 221 figures.

Contents:

Chapter I. Introduction.
Chapter II. Origin of Coal.
Chapter III. Carboniferous Basin of the Mississippi Valley.
Chapter IV. General Geology of the Coal Region.
Chapter V. Lithology of the Coal Measures.
Chapter VI. Stratigraphy of the Coal Measures.
Chapter VII. The Coal Beds.
Chapter VIII. Description of the Coal Beds now operated in North Central Iowa.
Chapter IX. Description of Coal Beds in Central Iowa.
Chapter X. Description of Coal Beds in Southeastern Iowa.
Chapter XI. Description of Coal Beds of Southwestern Iowa.
Chapter XII. Description of the Coal Beds of the Outliers in Eastern Iowa.
Chapter XIII. Composition of Iowa Coals.
Chapter XIV. Utilization of Coal Dust and Slack.
Chapter XV. The Coal Industries.

VOLUME III. ANNUAL REPORT (IN PRESS).

Contents:

Administrative Report of State Geologist.
Administrative Report of Assistant State Geologist.
Administrative Report of Chemist.
Work and Scope of the Geological Survey.
Gypsum Deposits of Iowa; by Charles Rollin Keyes.
Clay Industries of Western (half of) Iowa; by E. H. Lonsdale.
Certain Building Stones; by S. W. Byer.
Thickness of the Paleozoic Formation in Northeastern Iowa; by W. H. Norton.
Carboniferous and Devonian Outliers in Northeastern Iowa; by W. H. Norton.
Glacial Markings in Southeastern Iowa; by F. M. Fultz.
Cretaceous Rocks of the Sioux River; by H. F. Bain.
Zinc Industry; by A. G. Leonard.

In addition to the reports mentioned above, a number of papers announcing results worthy of special notice have appeared in some of the principal scientific journals and magazines. During the year articles of a popular character have been given to leading newspapers of the State. Besides bringing out facts of temporary value and supplying, in a measure an ever increasing demand for information in advance of the completed lines of investigation, these articles keep the public in close touch with the progress of the work in the different parts of the State. The usefulness of this feature and the deep and widespread popular interest taken in it has been very much greater than was at first anticipated. During the past year upwards of fifty articles of this kind have been sent to the various newspapers. The urgent demand for information concerning the different lines of work have been so numerous that even greater efforts in the same direction will be made during the coming season.

WORK IN PROGRESS.

As already explained, the general investigations regarding the natural resources of the State run along parallel lines to which the terms subject and areal work have been given. While covering the same ground in part they do not occasion necessarily duplication in either field work or publication. Of these two divisions the former, from its nature, must in the beginning receive greater attention. All the problems of economic importance and interest cannot be solved at once. Time is required to do the work carefully and thoroughly. It was seen at the outset that all the subjects could not be taken at once. Consequently it was necessary to make some selection before entering upon the work as a whole. Those subjects which were thought to most need immediate attention were taken up and the work pushed vigorously. At the same time a number of collateral subjects demanded prompt consideration and these were also investigated as far as circumstances permitted.

The following may be regarded as an outline of the subjects considered:

Work in progress—Coal deposits, clays, building stones, general geology, mapping, county resources.

Work taken up—Soils, gypsum, zinc and lead, minerals (not yet mined), road materials, lime, cement, oil and gas, fossils, statistics.

Work not yet begun—Lignites, peat, iron ores, mineral paint, sands, crystalline rocks, marls, mineral waters, other subjects.

JANUARY WEATHER REPORT.

The month of January, 1894, was unusually fine for this region. At the Central Station there were 14 cloudless days, 10 cloudy days and 7 partly cloudy days. The average temperature of the first decade was 21 degrees; second decade, 36 degrees; last decade, 8 degrees. The extreme cold weather of the month occurred on the 22d, 23d, 24th, 25th, 27th, 28th and 29th.

The daily mean temperature for the State, 19.3°, was about 3° above the normal for January. Ames reports the lowest temperature—37° below zero, on the 25th.

The average precipitation for the State, 1.09 inches, was about 0.6 of an inch below the normal. Keokuk reported the greatest amount—2.24 inches. The heaviest snow fall was 12 inches at Hawkeye and Mechanicsville.

The following table gives, as a basis of comparison, the mean temperature and total precipitation at the stations named, for the month of January, from 1872 to 1894, inclusive:

YEARS.	MEAN TEMPERATURE, DEGREES.						PRECIPITATION, INCHES.					
	Des Moines.	Davenport.	Dubuque.	Keokuk.	Omaha.	Sioux City.	Des Moines.	Davenport.	Dubuque.	Keokuk.	Omaha.	Sioux City.
1872	....	....	....	25	19	....	.....	....	.....	0.07	0.08	.....
1873	....	17	....	16	18	....	.....	3.56	.....	3.40	0.64	.....
1874	....	24	21	27	22	....	.....	4.34	2.45	3.92	0.32	.....
1875	....	9	7	16	11	....	.....	0.38	1.00	0.61	0.26	.....
1876	....	30	28	34	27	....	.....	3.47	3.20	0.68	0.22	.....
1877	....	17	15	22	20	....	.....	1.41	0.96	0.84	0.53	.....
1878	....	30	28	23	29	....	.....	0.36	0.49	0.17	1.13	.....
1879	19	18	17	21	22	....	0.69	0.79	0.44	0.50	0.07	.....
1880	36	38	34	41	34	....	0.70	3.13	1.95	3.91	0.90	....
1881	14	14	12	18	12	....	1.55	1.34	1.87	0.50	0.61	....
1882	27	29	24	28	28	....	0.63	0.90	0.84	1.07	0.74	.....
1883	9	16	10	16	12	....	1.72	1.16	1.59	1.24	1.01	.....
1884	16	19	14	19	17	....	0.85	0.75	0.99	0.85	0.73	.....
1885	12	17	12	16	12	....	1.00	2.10	1.80	2.44	0.41	.....
1886	11	13	13	15	7	....	3.47	2.22	3.17	2.08	1.15	.....
1887	12	13	11	19	12	....	0.83	1.43	3.33	1.48	0.49	.....
1888	7	10	7	15	8	....	1.15	1.54	1.20	1.57	0.58	.....
1889	22	25	22	28	24	....	1.22	0.95	1.55	1.89	1.02	.....
1890	21	27	22	29	18	14	2.62	2.49	2.31	1.81	1.44	1.14
1891	28	28	27	32	30	28	1.82	2.38	1.27	2.59	2.11	1.66
1892	18	17	15	20	18	15	1.60	1.60	2.34	1.96	0.42	0.41
1893	10	9	7	14	16	13	0.56	1.14	1.60	0.92	0.28	0.34
1894	21	24	22	28	21	15	1.09	1.33	1.11	2.24	0.51	0.60
Means	18	19	17	21	19	17	1.34	1.71	1.66	1.69	0.70	0.83

SUMMARY OF WEATHER CONDITIONS.

BAROMETER—Mean pressure for the month, 30.14 inches; highest observed, 30.81 inches at Clarinda, on the 24th; lowest observed, 29.44 inches at Davenport, on the 20th. Range for the State during the mont'i, 1.37 inches.

TEMPERATURE—Monthly mean as deduced from seventy-two voluntary observers' reports, 19.3°; highest monthly mean, 29.9° at Knoxville; lowest monthly mean, 9.2° at Seymour. The highest temperature reported was 85° at Centerville, on the 21st; the lowest temperature

reported was 37° below zero at Ames, on the 25th. Average daily maximum, 29.3°; average daily minimum, 9.5°; average monthly maximum, 55.8°; average monthly minimum, 25.3° below zero. Greatest monthly local range, 112° at Centerville; least monthly local range, 68 at Algona. Range for the entire State, 122°; average monthly range, 81.1°.

PRECIPITATION—Average for the State as determined from seventy-six voluntary observers' reports, 1.09 inches; the greatest amount reported, 2.24 inches at Keokuk; least amount reported, 0.31 inch at Humboldt; greatest amount of snow reported, 12 inches at Hawkeye and Mechanicsville. Average number of days on which .01 inch rain or melted snow fell, 4.7; average number of clear days, 14.3; part cloudy, 8.3; cloudy, 8.3.

AURORA—Alta on the 11th, faint low arch extending from the north point to 45 degrees northeast; much fainter and fading away at 8:30 P. M.

SLEET—Ovid, 19th.

POLAR BANDS—Amana, 13th.

LUNAR HALO—Alta, 15th, 16th and 21st; Amana, 21st; Fort Madison, 12th, 28th; Glenwood, 23d; Hopeville, 16th; Webster City, 22d and 23d; Ovid, 15th and 16th.

SOLAR HALO—Alta, 21st, 22d, 29th and 31st; Amana, 29th and 31st; Glenwood, 27th; Hopeville, 25th and 27th; Webster City, 27th and 29th; Ovid, 24th, 25th and 26th.

BLIZZARDS—Carroll on 23d; Greenfield, 23d; Grand Meadow, 11th; Rockwell City, 23d.

FOG—Quite general over the State on the 14th and 15th.

ATMOSPHERIC PRESSURE.

STATIONS.	Mean reduced barometer.	EXTREMES.			
		Highest barometer	Date.	Lowest barometer	Date.
Cedar Rapids	30.15	30.66	25	29.60	20
Clarinda	30.17	30.81	24	29.61	20
Cresco		30.78	25	29.54	20
Davenport	30.12	30.74	25	29.44	20
Des Moines	30.14	30.74	25	29.57	20
Dubuque	30.11	30.74	25	29.47	20
Keokuk	30.12	30.74	25	29.56	20
Omaha (Neb)	30.16	30.78	24	29.65	17
Sioux City	30.15	30.78	23	29.64	16
Means	30.14	30.81	24	29.44	20

WIND MOVEMENT.

STATIONS.	Miles.	Maximum velocity.	Direction.	Date.
Davenport	7,082	40	W	11
Des Moines	5,986	32	SE	19
Dubuque	4,138	24	W	11
Keokuk	6,013	35	W	11
La Crosse (Wis)	5,222	30	NW	11
Omaha (Neb)	5,587	26	NW	23
Sioux City	7,474	36	NW	21

OBSERVERS' NOTES.

Williams—MERTON L. FULLER: Indifferent weather for grain and grass. Stock generally healthy, excepting considerable loss from hog cholera.

Amana—CONRADT SCHADT: The lowest temperature was 29° below zero on the 25th which was the lowest for quite a number of years. The following days are the coldest on record for several winters:

YEARS.	DATE.	Lowest point reached—Below zero.
1886	December 27th	23.5
1887	January 6th	25
1888	January 15th	27
1889	February 23d	13.8
1890	January 22d	18
1891	November 29th	12.6
1892	January 19th	21.2
1893	January 13th and 17th	19
1894	January 25th	29

College Springs—A. A. BERRY: A very open January although a week of severe weather. Fall wheat has suffered slightly with drought. Quite a lot of thawing and freezing and it being so dry injures the fall wheat.

Keokuk—FRED. Z. GOSEWISCH: From January 10th to 20th frost was entirely out of the ground and farmers engaged in plowing. First ice cutting began on the 26th, and continued to the 31st; from 6 to 7½ inches in thickness but of poor quality.

SPIRIT LAKE, December, 1893: Mean temperature, 16.6; mean maximum, 27.5; mean minimum, 57; highest temperature observed, 47 on the 23d; lowest observed, 21 below zero on the 1st; total rainfall, 1.44 inches; total snowfall, 6.0 inches; prevailing wind, southeast; number of clear days, 19; partly cloudy, 10; cloudy, 2; rain or snow, 2.

CEDAR FALLS, December, 1893: Mean temperature, 19.2; mean maximum, 27.8; mean minimum, 10.5; highest temperature observed, 52 on the 24th; lowest temperature observed, 12 below zero on the 12th; total precipitation, 1.00 inch; number of clear days, 17; partly cloudy, 6; cloudy, 8; rain or snow fell on, 1; prevailing wind, south.

MONTHLY AND ANNUAL PRECIPITATION FOR STORM LAKE, IOWA.

A. J. BOND, OBSERVER.

YEAR.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
1884	0.03	0.64	1.37	2.31	1.12	1.70	5.17	3.56	3.47	2.61	0.14	1.15	23.23
1885	0.85	0.42	0.20	0.87	4.90	4.58	3.40	1.63	2.42	1.89	1.08	0.44	22.68
1886	1.28	0.36	1.16	1.98	1.92	2.97	1.01	1.47	2.18	0.78	1.33	0.86	17.30
1887	0.29	0.62	0.39	0.91	1.68	2.21	4.36	1.83	9.89	0.76	0.70	1.38	25.02
1888	1.33	0.54	2.84	4.15	5.92	2.75	3.02	4.79	1.22	0.46	0.03	0.50	27.55
1889	1.00	0.40	0.35	1.79	3.07	4.86	6.17	1.52	1.34	0.36	1.46	0.76	23.08
1890	1.16	0.44	1.90	2.69	2.50	5.86	3.38	3.99	2.82	2.57	1.05	0.44	28.80
1891	1.61	1.02	1.33	1.83	2.88	14.70	5.28	3.16	1.70	4.36	0.72	2.28	40.82
1892	0.37	0.90	1.54	5.64	7.26	2.28	2.21	2.77	0.67	0.65	0.25	0.53	25.09
1893	0.17	1.48	2.60	2.72	3.41	3.34	3.99	1.90	0.90	0.10	1.03	1.46	23.10
Average	0.81	0.68	1.37	2.49	3.47	4.52	3.79	2.66	2.66	1.45	0.78	0.98	25.67

The greatest annual precipitation was 40.82 inches in 1891; the least annual precipitation was 17.30 inches in 1886. The greatest monthly precipitation was 14.70 inches in June, 1891; the least monthly precipitation was 2.03 in January, 1884.

MARCH WEATHER.

FROM UNITED STATES WEATHER BUREAU RECORDS.

The following data, compiled from the records of observations taken during the length of time given at each station, show the average and extreme conditions during that time, and also the range within which weather variations may be expected to keep in any future March:

	Des Moines (15 years).	Davenport (22 years).	Dubuque (20 years).	Keokuk (22 years).	Omaha, Neb. (22 years).	La Crosse, Wis. (21 years).
Mean or normal temperature	35°	35°	32°	37°	35°	30°
Warmest March	1889	1878	1878	1878	1878	1878
Average	42°	50°	47°	50°	48°	47°
Coldest March	1891	1877	1888	1891	1881	1888
Average	29°	26°	26°	31°	28°	22°
Highest temperature recorded	80°	74°	71°	80°	82°	72°
Date	26th, 1880	30th, 1875	8th, 1879	30th, 1875	27th, 1879	30th, 1875
Lowest temperature recorded	-8°	-8°	-12°	-6°	-7°	-23°
Date	15th, 1890	1st, 1890	2d, 1890	1st, 1890	14th, 1880	4th, 1873
Average date on which last "killing" frost occurred (in spring)	May 17th	April 25th	April 28th	April 9th	April 15th	May 20th
Average precipitation (inches)	1.50	2.18	2.30	2.16	1.56	1.63
Average number of days with .01 inch or more	9	10	10	10	8	9
Greatest monthly precipitation	3.09	4.35	4.53	3.78	4.91	4.23
Date	1888	1876	1877	1878	1884	1876
Least monthly precipitation	0 04	0.17	0.30	0.17	0.18	0.13
Date	1885	1885	1889	1885	1871	1883
Greatest amount in 24 consecutive hours	1.43	1.91	2.53	1.98	1.07	2.05
Date	26th, 1882	25th, 1884	20th & 21st, 1886	30th, 1872	26th, 1892	27th, 1880
Greatest amount snowfall in 24 hours (inches)	7.2	3.0	10.1	7.5	2.0	11.0
Date	28th, 1886	20th, 1888	27th, 1887	20th, 1886	26th, 1892	8th, 1891
Average number clear days	9	8	7	6	9	8
Partly cloudy	12	12	13	14	12	13
Cloudy	10	11	11	11	10	10
Prevailing direction of wind	N	NW	NW	NW	N	NW
Highest velocity, miles per hour	42	54	40	48	52	42
Date	10th, 1892	9th, 1892	25th, 1890	7th, 1874	27th, 1880	14th, 1880

BELATED REPORTS.

The following reports were received too late for publication in the last MONTHLY REVIEW:

COUNCIL BLUFFS, November, 1893: Mean temperature, 36.2; mean maximum, 48.5; mean minimum, 24 0; highest observed, 71 on the 1st; lowest observed, zero on the 30th; rainfall not given.

COUNCIL BLUFFS, December, 1893: Mean temperature, 26.1; mean maximum temperature, 37.5; mean minimum temperature, 14.7; highest temperature observed, 58 on the 23d; lowest observed, 4 below zero on the 1st and 3d; no rain reported.

METEOROLOGICAL DATA FOR JANUARY, 1894.

STATIONS.	TEMPERATURE OF THE AIR (IN DEGREES FAHRENHEIT).								PRECIPITATION IN INCHES.			Prevailing direction of wind.	Killing frost.	No. of cloudless days.	No. of partly cloudy days.	No. of cloudy days.	No. of rainy days. (.01 inch or more).	No. of hail-storms.	No. of thunder-storms.
	Monthly mean.	EXTREMES. Mean maximum.	Mean minimum.	Maximum.	Date.	Minimum.	Date.	Monthly range.	Monthly.	Total snowfall.	Depth of unmelted snow at end of month.								
Algona	13 0	.....	.....	44	1	-24	24	68	1.05	8.0	.....	NW	....	12	12	7	4	...	...
Alta	12.3	21.5	3.1	47	16	-28	24	75	0.71	5.6	.....	NW	....	11	11	9	6	...	...
Ames (Fred L. Kent)	15.6	27.6	3.5	55	13	-37	25	92	1.06	6.6	.....	NW	...	21	10	0	6	...	...
Ames (W. H. Heilman)	.....	.....	.....	.....	.....	.....	.....	.....	0.57	3.5	.....	.....	....	.....	.....	.....	.....	...	...
Amana	20.4	29.6	11.2	58	17	-29	25	87	1.13	5.0	.....	NW	....	21	1	9	4	...	...
Atlantic	19.0	31.4	6.5	60	16	-28	25	88	0.95	6.5	.....	NW	....	15	5	11	4	...	...
Audubon	18.0	28.4	7.6	56	16	-26	25	82	1.10	9.0	.....	NW	....	9	6	16	3	...	...
Belle Plaine	18.7	28.1	9.3	59	17	-28	25	87	1.20	5.0	.....	S	...	13	7	11	6	...	...
Bonaparte	25.6	36.0	15.2	52	1	-18	24-25	70	1.40	.....	.....	.....	....	.....	.....	.....	.....	...	...
Carroll	17.4	27.3	7.5	56	1-16	-30	25	86	1.17	9.5	.....	.....	...	17	10	4	4	...	...
Cedar Falls	16.9	27.2	6.5	56	17	-27	25	83	1.75	7.5	.....	NW	....	21	2	8	4	...	...
Cedar Rapids	21.9	29.7	14.2	58	17	-23	25	81	1.51	7.5	.....	NW&N	...	17	3	11	5	...	...
Centerville	28.8	45.2	12.4	85	21	-27	23	112	1.50	...	.....	NW	....	21	7	3	1	...	...
Charles City	15.6	22.7	8.5	52	15-17	-26	25	78	1.42	7.0	.....	NW	....	.....	.....	.....	8	...	...
Clarinda	20.4	30.0	10.8	50	1	-22	24	72	0.68	3.0	.....	N	....	17	4	10	5	...	...
College Springs	22.0	32.9	11.2	60	16	-24	24	84	0.98	2.0	.....	NW	....	17	3	11	3	...	...
Corning	22.2	33.4	11.1	59	16	-24	25	83	0.89	5.0	.....	SW	...	16	4	11	3	...	...
Cresco	14.1	22.9	5.2	52	17	-24	25	76	0.99	6.0	.....	NW	....	11	9	11	5	...	...
Davenport	24.0	30.9	17.4	62	17	-21	25	83	1.33	.....	.....	W	...	12	11	8	9	...	...
Decorah	16.3	25.1	7.4	53	17	-24	24	77	1.14	7.5	.....	.....	....	17	4	10	5	...	...
Delaware	17.6	.....	.....	55	17	-28	25	83	0.96	6.3	.....	NW	....	13	8	10	9	...	...
Denison	13.9	22.7	5.1	52	16	-28	25	80	0.95	7.0	.....	NW	....	.....	.....	.....	5	...	...
Des Moines	21.0	30.4	11.7	55	1	-27	25	82	1.09	6.0	.....	NW	....	14	7	10	6	...	...
Dubuque	22.0	29.9	13 7	60	17	-22	25	82	1.11	.....	.....	S	...	10	9	12	6	...	...
Elkader	19.0	29.8	8.1	57	17	-27	25	84	0.91	7.0	.....	N	....	18	5	8	5	...	...
Fairfield	23.1	31.6	14.6	64	17	-17	24	81	1.57	3.4	.....	NW	....	9	11	11	9	...	...
Ft. Madison	28.6	.....	.....	64	17	-16	25	80	2.15	3.0	.....	S & SW	....	7	14	10	4	...	...
Galva	14.2	24.3	4.1	51	16	-29	25	80	0.32	3.2	.....	NW	....	6	18	7	4	...	...
Glenwood	23.2	35.7	10.7	62	17	-22	24	84	0.49	2.0	.....	N	....	18	7	6	3	...	...
Grand Meadow	18.7	.....	.....	54	17	-22	25	76	1.18	9.0	.....	NW	....	11	8	12	5	...	...
Greenfield	20.4	31.7	8.9	58	1	-25	24	83	0.90	6.1	.....	W, NW	...	10	12	9	5	...	...
Grinnell	22.1	29.4	12.8	57	17	-20	25	77	0.91	4.8	.....	NW	....	15	6	10	4	...	...
Grundy Center	16.0	26.7	5.3	58	17	-26	24-25	84	1.00	4.0	.....	NW & S	....	19	6	6	7	...	...
Hampton	14.4	24.0	4.8	52	17	-27	25	79	1.05	8.3	.....	NW	....	14	12	5	5	...	...
Hawkeye	.....	.....	.....	.....	.....	.....	.....	.....	1.89	12.0	.....	.....	....	.....	.....	.....	4	...	...
Hopeville	22.0	31.8	12.1	56	17	-22	24-25	78	0.74	2.5	.....	NW	....	7	18	6	6	...	...
Hopkinton	23.0	29.3	16.9	56	17	-26	25	82	1.30	8.0	.....	NW	....	.....	.....	.....	7	...	...
Humboldt	.....	.....	.....	.....	.....	.....	.....	.....	0.31	9.0	.....	NW	....	20	7	4	3	...	...
Independence	19.4	30.4	8.5	55	17	-28	25	83	0.87	5.2	.....	NW	....	16	7	8	3	...	...
Indianola	23.1	34.8	10.9	57	17	-25	25	82	0.68	.....	.....	NW	....	.....	.....	.....	2	...	...
Iowa City	24.6	35.3	13.8	61	18	-30	25	91	2.00	11.0	.....	NW	....	11	11	9	5	...	...
Iowa Falls	13.7	23.9	3.5	50	13	-33	25	83	0.72	8.0	.....	NW	....	.....	.....	.....	4	...	...
Keokuk	28.0	36.0	20.0	69	17	-16	24	85	2.24	2.8	.....	N	....	14	8	9	7	...	...
Keosauqua	25.6	34.2	17.0	63	17	-16	24	79	1.52	2.0	.....	.....	....	.....	.....	.....	3	...	...
Knoxville	29.9	30.0	11.8	57	17	-22	25	79	0.90	4.0	.....	NW	....	13	9	9	3	...	...
Larrabee	12.6	22.9	2.2	48	13	-28	24	76	0.78	7.2	.....	.....	....	13	11	4	5	...	...
Logan	17.9	28.1	7.8	51	1	-26	25	77	0.74	7.0	.....	NW	...	18	5	8	3	...	...
Le Claire	.....	.....	.....	.....	.....	.....	.....	.....	1.81	.....	.....	.....	....	.....	.....	.....	.....	...	...
Maxon	20.2	.....	.....	56	17	-28	25	84	1.20	4.5	.....	.....	....	7	14	10	4	...	...
Mechanicsville	20.8	29.0	12.5	59	17	-22	25	81	1.45	12.0	.....	S	....	11	8	12	8	...	...
Monticello	18.7	.....	.....	57	17	-30	25	87	1.08	5.4	.....	NW	....	20	3	8	6	...	...
Mt. Vernon	20.8	.....	.....	59	17	-25	25	84	.....	.....	.....	.....	....	.....	.....	.....	.....	...	...
Muscatine	25.9	.....	.....	62	.....	-21	.....	83	1.80	7.2	.....	.....	....	.....	.....	.....	.....	...	...
Newton	19 4	30.0	8.8	58	17	-27	25	85	0.69	5.5	.....	S	...	19	5	7	3	...	...
Omaha	21.0	29.0	11.5	61	16	-22	24	83	0.51	.....	.....	NW	....	13	4	14	7	...	...
Osage	12.5	.....	.....	45	17	-24	25	69	0 75	5 0	.....	N	....	9	8	14	5	...	...
Oskaloosa	22.0	31.8	12.4	51	17	-27	25	78	1.19	4.5	.....	NW	....	18	1	12	6	...	...
Ottumwa	20.6	35.4	16.4	63	17	-20	25	83	2.10	3.5	.....	W	....	13	15	3	5	...	...
Ovid	23.8	34.9	12.7	61	17	-25	25	86	1.21	5.2	.....	NW	....	12	9	10	5	...	...
Panama	17.5	27.9	7.2	55	16	-25	24	80	0.37	2.0	.....	NW	....	13	8	10	3	...	...
Richland	21.0	.....	.....	.....	.....	.....	.....	.....	1.65	4.0	.....	.....	....	5	19	7	7	...	...
Rockwell City	.....	.....	.....	.....	.....	.....	.....	.....	0.75	.....	.....	.....	....	20	3	8	3	...	...
Rock Rapids	9.6	21.4	-2.2	41	16	-29	24	70	0.65	6.5	.....	N	....	15	12	4	5	...	...
Sac City	14.0	22.7	5.8	47	13	-30	25	77	1.35	5.0	.....	NW	....	12	12	7	5	...	...
Seymour	25.6	36.2	14.9	62	17	-20	24	82	1.17	5.0	.....	S	....	23	5	3	3	...	...
Sibley	9.2	18 9	- .4	40	15	-30	24	70	0.97	9.4	.....	NW	...	18	7	6	4	...	...
Sioux City	15.0	23.6	5.7	52	16	-28	24	78	0 60	.....	.....	NW	....	12	10	9	6	...	...
Spirit Lake	10.3	20.9	00.3	45	13	-30	25	75	0.80	8.0	.....	NW	...	17	7	7	2	...	...
Tipton	23.3	32.8	13.8	61	17	-26	25	87	1 62	8.2	.....	W	....	18	10	3	5	...	...
Toledo	19 7	.....	.....	58	17	-30	25	88	0 72	3.5	.....	NW	....	21	10	0	2	...	...
Villisca	19.2	29.9	8.5	54	16	-22	22	76	0.93	5.1	.....	NW	...	.....	.....	.....	4	...	...
Vinton	16.5	.....	.....	57	17	-30	25	87	0.88	6.0	.....	NW	....	19	3	9	4	...	...
Washington	23.2	.....	.....	62	17	-24	25	86	1.10	6.5	.....	NW	....	6	15	10	4	...	...
Webster City	15.3	.....	.....	50	13	-26	25	76	1.12	6.6	.....	NW	....	18	5	8	4	...	...
West Bend	10.7	.....	.....	48	13	-26	24	74	0 90	9.0	.....	NW	....	.....	.....	.....	.....	...	...
Williams	14.4	.....	.....	46	1	-27	25	73	0.87	5.0	.....	NW	....	11	11	9	4	...	...
Winterset	21.2	30.7	11.6	57	15	-26	25	83	0.85	6.0	.....	NW	....	7	12	12	4	...	...
Means	19.3	29.3	9.5	....	....	-37	...	81	1.09	6.0	.....	NW	....	14.3	8.3	8.3	4.7	...	...

DAILY AND MONTHLY MEAN TEMPERATURE FOR JANUARY, 1894.

STATIONS.	DATE.																													Monthly Mean.
	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	31st.	
Algona	36	24	10	6	10	3	-5	0	8	23	14	30	36	34	34	37	30	23	32	27	8	-6	-13	-19	-2	-2	-5	14	4	12	8	13.0
Alta	32	24	14	8	6	-3	0	2	14	16	23	33	33	33	30	37	30	23	34	28	9	-5	-14	-20	-8	4	-2	15	0	12	9	12.3
Ames (Fred L. Kent)	37	29	18	17	10	2	-1	6	5	18	24	25	36	34	38	35	42	28	34	32	22	0	-8	-21	-17	9	0	12	4	15	12	15.6
Amana	37	38	27	16	15	9	6	15	18	22	22	32	36	36	44	42	48	30	28	40	26	6	0	-6	-14	-7	-6	14	8	16	16	20.4
Atlantic	39	35	26	18	16	1	-7	14	6	25	33	30	34	40	38	44	37	30	26	32	18	5	-10	-14	-8	12	9	17	8	17	11	19.0
Audubon	43	35	23	14	12	4	2	8	8	20	28	28	38	38	37	44	36	32	25	33	16	2	-5	-16	-9	12	4	16	6	16	10	18.0
Belle Plaine	38	38	24	15	15	8	4	15	14	20	18	24	38	34	40	40	46	29	27	38	24	4	-6	-14	-14	8	4	14	6	14	14	18.7
Bonaparte	40	41	32	24	18	18	16	26	26	25	30	26	35	38	42	38	54	38	29	41	37	16	5	-10	-4	12	16	20	18	26	19	25.6
Carroll	38	34	24	15	13	4	3	5	13	30	19	26	36	38	36	44	34	23	25	36	12	-1	-13	-20	-12	8	7	21	14	17	14	17.4
Cedar Falls	32	28	24	12	13	3	0	8	13	17	18	24	39	36	34	39	44	30	26	36	25	-4	-3	-16	-16	7	6	16	4	13	16	16.9
Cedar Rapids	32	36	26	18	17	12	9	16	18	24	32	36	38	40	42	14	48	32	31	41	34	8	2	-10	-10	6	6	16	13	18	16	21.9
Centerville	40	40	35	27	28	25	22	26	24	32	26	28	31	31	40	45	56	61	58	50	52	17	12	-9	3	7	14	18	21	34	38	28.8
Charles City	35	32	19	8	8	2	-6	4	10	16	16	26	35	35	45	43	47	30	30	37	22	-4	-11	-18	-13	0	-2	14	2	16	12	15.6
Clarinda	38	36	20	18	16	8	15	22	10	24	24	30	34	42	40	42	32	29	28	32	19	5	-5	-15	-6	14	9	20	10	32	12	20.4
College Springs	41	42	24	22	16	8	16	26	12	26	29	34	31	41	40	45	40	31	29	34	25	7	-6	-14	-4	9	10	22	12	24	14	22.0
Cornlng	42	38	27	20	15	10	14	24	16	26	29	34	36	41	42	45	40	32	27	36	26	7	0	-14	-8	13	10	20	10	26	12	22.2
Cresco	32	32	20	8	10	0	-6	2	9	15	10	26	34	31	38	40	40	28	32	32	14	-1	-10	-14	-10	0	0	11	4	12	11	14.1
Davenport	36	42	34	32	18	13	11	24	25	23	26	36	38	42	42	38	42	32	32	40	36	12	10	-10	-8	10	8	18	12	20	18	24.1
Decorah	38	31	21	18	19	-3	-2	12	8	16	12	25	36	32	38	44	38	26	32	30	12	1	8	-16	2	-1	2	12	12	11	10	16.3
Delaware	34	34	28	14	15	12	0	10	14	19	15	24	31	38	39	40	46	26	30	35	22	6	-1	-14	-18	2	-1	14	9	12	11	17.6
Denison			16	14	10	6	2	5	6	20	20	24	32	34	34	42	30	24	30	30	13	-1	-14	-18	-10	7	2	16	4	16	14	13.9
Des Moines	42	39	24	20	14	8	11	19	10	26	25	31	40	38	46	44	44	32	28	36	23	7	-4	-14	-11	12	6	16	8	17	16	21.0
Dubuque	36	40	30	26	17	16	7	14	20	23	26	25	40	35	42	42	52	34	29	40	26	10	4	-5	-9	4	5	12	16	14	17	22.0
Elkader	32	36	28	18	18	9	2	8	16	22	26	22	36	33	40	40	46	33	27	41	28	8	-2	-8	-8	6	6	10	12	10	12	19.0
Fairfield	36	40	32	25	17	16	15	24	22	26	26	28	38	...	41	38	50	33	31	40	29	10	0	-12	-5	10	8	14	12	16	14	23.1
Ft. Madison	36	42	35	29	26	25	22	26	30	32	26	32	38	43	45	43	56	38	36	42	38	18	14	-6	1	16	18	25	14	26	16	28.6
Galva	30	30	20	8	4	1	0	2	3	17	20	27	35	34	36	40	36	23	25	30	14	-5	-8	-20	-9	6	6	21	3	12	7	14.2
Glenwood	42	38	34	26	16	8	14	22	12	27	30	37	42	41	42	45	46	38	28	33	24	2	-6	-12	-3	20	11	25	14	26	12	23.2
Grand Meadow	38	35	29	14	15	6	1	8	17	24	14	27	35	38	39	42	42	28	28	36	16	4	-6	-14	-6	2	2	18	10	14	14	18.7
Greenfield	42	38	33	17	14	8	12	17	14	24	26	31	38	40	42	42	41	36	28	34	20	5	-4	-18	-8	13	5	18	6	18	11	20.4
Grinnell	38	38	30	17	14	11	10	16	16	24	26	30	38	38	40	38	48	29	30	37	24	5	0	-14	-10	8	4	17	15	17	17	21 1
Grundy Center	37	30	13	14	8	4	6	8	8	22	14	30	38	38	42	40	39	28	31	32	14	0	-13	-18	-10	5	2	12	4	11	10	18.0
Hampton	33	34	15	10	6	-2	1	4	6	15	14	23	30	34	40	36	40	26	26	32	19	-3	-11	-18	-12	4	0	12	2	11	7	14.4
Hopeville	40	38	26	19	14	12	14	24	16	26	28	30	37	41	44	44	44	32	30	35	24	6	-2	-16	-8	13	8	18	9	24	12	22.0
Hopkinton	38	40	31	19	18	15	7	14	20	22	21	28	36	40	42	44	51	32	33	42	30	12	8	-8	-11	9	6	19	14	22	20	23.0
Independence	33	36	30	16	14	9	2	10	16	18	28	32	35	36	39	40	48	35	29	38	26	8	2	-10	-14	2	4	10	12	12	16	19.4
Indianola	42	44	36	17	...	14	12	18	12	26	31	34	40	...	46	44	46	34	35	38	28	13	0	-8	-9	12	7	16	14	18	14	24.6
Iowa City	37	40	30	20	17	18	13	19	26	26	30	28	36	36	42	42	53	32	34	40	36	9	9	-8	-5	8	12	16	19	18	...	24.6
Iowa Falls	28	32	20	11	6	-1	-4	4	3	14	18	22	34	34	38	36	38	28	28	32	18	-4	-14	-22	-16	5	6	16	2	10	10	13.7
Keokuk	44	47	32	27	32	22	20	29	36	30	28	30	40	43	45	44	36	35	32	44	40	12	10	-2	-3	14	17	24	13	30	26	28.0
Keosauqua	38	41	32	24	16	18	18	26	35	29	29	28	36	40	40	40	52	35	30	42	36	14	6	-8	-3	14	14	18	19	26	19	25.6
Knoxville	39	36	24	18	13	14	12	20	13	25	23	29	37	38	46	42	48	32	30	38	28	15	4	-14	-8	6	6	14	6	18	15	20.9
La Crosse (Wis.)	32	38	22	14	14	10	2	-3	6	16	14	24	32	32	40	40	49	31	28	38	19	3	-6	-6	-6	3	4	16	13	10	8	18.0
Larrabee	34	25	13	3	1	-2	-1	2	2	20	18	24	37	34	30	38	33	23	25	28	10	-6	-10	-20	-7	2	2	16	2	12	8	12 9
Logan	40	36	16	10	12	-1	2	6	2	18	24	36	37	38	38	40	31	24	28	38	13	3	-8	-16	-6	10	10	22	13	20	12	17 9
Maxon	42	37	23	17	15	7	12	22	9	28	19	34	42	42	42	38	46	32	33	42	35	25	4	-6	-20	-6	10	4	24	2	18	11	20.2
Mechanicsville	34	36	29	18	15	12	6	16	20	24	21	24	35	41	40	41	50	30	28	38	31	8	2	-12	-10	6	5	14	10	18	16	20.8
Monticello	38	38	28	16	18	10	4	14	13	24	14	24	32	38	40	41	44	26	30	36	20	6	-1	-15	-12	3	0	20	8	16	12	18.7
Mt. Vernon	39	38	26	15	18	8	9	20	15	32	17	27	36	42	42	46	43	28	34	39	21	6	-2	-18	-8	8	3	24	6	15	14	20.8
Newton	38	39	28	16	12	10	7	16	14	22	26	28	38	35	42	38	48	26	28	35	20	4	-2	-16	-12	6	2	15	13	13	14	19 4
Omaha (Neb)	42	36	16	17	12	4	14	13	4	26	26	38	42	42	36	48	36	30	33	37	17	-2	-7	-14	0	16	6	23	12	24	14	21.0
Osage	32	30	16	3	6	-4	-10	0	6	16	12	17	32	34	40	40	38	22	28	33	14	-6	-9	19	-12	-3	-4	15	0	11	10	12.5
Oskaloosa	38	38	28	19	14	14	10	22	18	26	26	33	38	38	42	39	42	31	29	40	30	8	0	-14	-10	14	9	18	12	18	18	22.0
Ottumwa	41	42	31	22	18	18	16	24	28	28	25	33	46	40	46	45	47	37	30	40	30	14	7	-12	-6	14	10	20	16	24	18	25.2
Ovid	41	38	26	22	16	14	16	27	18	28	25	30	36	40	46	45	47	37	30	40	30	10	-3	-12	-8	12	13	18	9	25	16	23.8
Panama	39	37	32	14	10	3	2	10	7	20	24	30	36	38	36	43	34	27	29	32	10	0	-6	-16	-7	10	6	19	7	18	10	17.5
Richland	38	37	24	16	16	8	12	22	14	27	28	33	36	40	38	41	42	28	32	37	24	8	7	-16	-4	8	3	25	5	21	13	21.0
Rock Rapids	30	32	16	0	2	-4	-12	-5	0	11	20	18	32	26	25	34	28	22	18	9	-13	-8	-20	-1	1	3	10	3	4	8	9.6
Sac City	36	20	17	18	8	-2	0	2	6	18	14	22	36	36	35	34	33	24	30	32	24	-4	-12	-18	-12	6	0	17	2	14	8	14.0
Seymour	40	40	34	21	16	16	14	18	25	31	30	30	33	34	46	44	51	35	31	40	35	16	4	-12	14	12	13	20	17	26	19	25.6
Sibley	30	22	10	-2	-2	-4	-8	-5	-2	11	14	20	30	29	30	34	31	17	23	28	10	-8	-10	-25	-10	-2	-2	12	0	11	6	9.2
Sioux City	36	28	8	5	-2	-2	-2	-2	-2	11	18	23	32	38	36	33	42	30	27	34	29	11	-5	-12	-16	- 1	9	2	17	4	18	10	14.6
Spirit Lake	32	25	10	-2	-2	-7	-4	-8	-5	-2	11	18	24	34	30	26	34	30	27	24	29	9	-9	-12	-20	-18	-4	-6	15	3	12	8	10.3
Tipton	37	40	30	20	16	14	10	20	13	24	28	26	36	38	42	43	52	37	47	40	26	8	3	-10	-11	10	4	16	20	18	16	23.3
Toledo	42	34	23	15	16	3	8	13	13	26	19	30	35	40	44	42	47	31	32	38	23	6	- 5	-16	-11	8	4	20	6	18	14	19.7
Villisca	36	32	19	16	11	6	10	20	11	25	24	26	34	44	36	42	33	28	32	38	16	2	-10	-12	- 5	12	10	18	17	20	12	19 2
Vinton	39	35	24	15	18	6	7	17	12	29	17	29	37	40	40	43	42	20	32	36	20	6	- 4	-15	- 9	7	4	20	7	18	14	16.5
Washington	38	28	29	19	18	14	14	22	18	28	30	36	44	42	45	48	30	33	40	29	8	3	- 4	- 2	10	7	7	27	9	22	15	23.2
Webster City	34	30	18	10	11	-4	0	11	3	24	12	27	36	32	34	37	36	26	32	32	13	0	-10	-16	- 4	4	2	19	2	14	10	15.3
West Bend	36	32	10	4	-7	-9	-6	-3	-1	21	10	28	37	30	32	36	30	18	28	33	7	-6	-14	-22	- 4	-4	-3	13	-1	9	7	10.7
Williams	34	29	14	9	10	-7	1	10	2	24	14	29	35	38	36	38	34	24	31	31	12	-2	-13	-22	- 5	0	5	14	3	12	6	14 4
Winterset	42	43	22	18	13	6	12	17	10	25	24	30	40	40	48	44	46	31	33	34	29	6	- 7	-17	-10	15	6	17	7	18	13	21.2

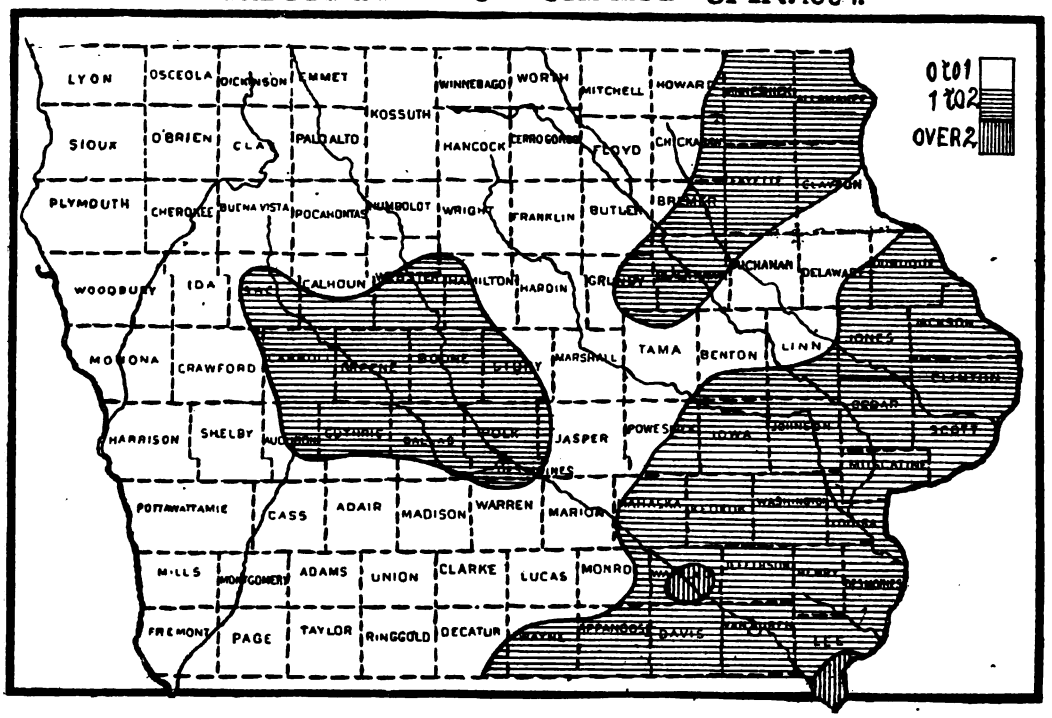
DAILY AND MONTHLY PRECIPITATION FOR JANUARY, 1894.

STATIONS.	DATE. 1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	31st.	Total.
Algona	...	...	...	T	0.25	...	...	...	...	...	...	...	...	...	...	...	T	...	0.45	...	...	...	0.10	...	...	...	...	0.25	...	...	...	1.05
Alta	...	...	0.01	...	0.12	...	...	...	...	...	...	...	...	...	...	...	0.03	...	0.20	...	...	...	0.20	...	...	...	...	0.15	...	...	...	0.71
Ames (Fred L. Kent)	...	...	...	...	0.12	...	...	...	...	...	...	...	...	0.01	...	0.02	...	...	...	0.43	...	...	0.42	...	...	...	...	0.05	...	...	...	1.06
Ames (W. H. Heilman)	...	...	...	...	0.12	...	...	...	...	...	...	...	...	...	...	...	0.01	...	0.37	...	0.04	...	...	...	...	T	...	0.03	...	...	...	0.57
Amana	...	...	...	...	...	0.05	...	...	...	...	...	...	...	...	...	...	...	...	...	0.50	0.11	...	...	0.47	...	T	T	...	...	...	...	1.13
Atlantic	...	...	...	...	...	0.20	...	...	...	...	...	...	...	...	...	...	...	...	...	0.30	...	...	0.40	...	...	...	0.05	T	...	...	...	0.95
Audubon	...	...	...	...	0.30	...	...	...	...	...	...	...	...	...	0.20	...	...	...	...	...	...	...	0.60	...	...	...	...	...	...	...	...	1.10
Belle Plaine	...	...	0.05	...	0.10	...	...	...	...	...	...	...	...	...	...	...	...	...	0.62	0.08	...	...	0.30	...	...	0.05	T	...	...	...	...	1.20
Bonaparte	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1.40	...	...	...	...	...	...	...	...	...	...	...	1.40
Carroll	...	...	...	...	...	0.45	...	...	...	...	...	...	...	...	...	...	...	...	...	0.22	...	...	...	0.40	...	...	...	0.10	...	...	...	1.17
Cedar Falls	...	...	...	...	...	0.30	...	...	...	...	...	...	...	...	...	...	...	...	...	1.00	...	...	0.30	...	...	...	...	0.15	...	...	...	1.75
Cedar Rapids	...	...	...	...	...	0.05	...	...	...	...	...	...	...	...	...	T	...	...	0.47	0.33	...	0.11	0.54	...	...	...	...	...	0.02	...	...	1.51
Centerville	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1.50	...	T	...	...	...	...	...	...	...	...	...	1.50
Charles City	...	...	.50	.50	...	0.25	...	...	...	...	...	...	...	...	0.14	...	...	...	...	0.38	...	0.05	0.15	...	...	...	...	0.35	...	...	...	1.42
Clarinda	...	...	...	...	0.02	...	...	...	...	...	...	...	...	...	...	...	...	...	0.40	...	...	T	0.20	...	...	...	0.01	0.02	...	...	...	0.68
College Springs	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.76	...	...	...	0.20	...	...	...	...	...	...	...	...	0.96
Corning	...	...	...	...	...	...	...	...	...	...	...	...	...	T	...	...	...	...	...	0.30	...	...	0.30	...	...	0.20	...	...	T	...	...	0.89
Cresco	...	...	0.04	...	...	0.20	...	...	...	...	...	...	...	...	...	...	...	T	...	0.47	...	...	0.18	...	...	...	...	0.10	...	...	T	0.99
Davenport	...	...	0.01	T	...	0.03	...	...	...	...	...	...	...	...	...	...	...	...	0.02	0.79	T	...	0.30	0.10	...	0.02	0.01	T	0.05	...	...	1.33
Decorah	...	...	...	...	0.22	...	...	...	...	...	...	...	...	...	...	...	...	...	0.42	0.14	...	T	0.14	...	...	...	...	0.22	...	...	...	1.14
Delaware	...	...	0 03	...	...	0.06	...	...	...	...	...	...	...	0.01	0.01	0.01	...	...	0.24	0.26	...	...	0.28	...	...	...	...	0.06	...	...	...	0.96
Denison	...	...	...	...	0.30	...	...	...	...	...	...	...	...	...	...	...	...	0.05	0.25	...	...	...	0.30	...	...	...	...	0.05	...	...	...	0.95
Des Moines	...	...	0.01	T	...	0.06	...	...	T	...	T	...	...	T	T	...	...	...	0.01	0.45	...	T	0.52	...	...	...	0.04	T	T	...	...	1.09
Dubuque	...	...	...	T	...	0.05	...	...	...	...	...	...	...	...	...	...	...	...	...	0.62	...	...	0 28	0.03	...	T	...	0.06	0.07	...	...	1.11
Elkader	...	...	...	...	...	0.06	...	...	...	...	...	...	...	...	...	...	...	...	0.10	0 42	...	...	0.19	...	...	...	...	0.14	...	...	...	0.91
Fairfield	...	...	0.01	...	0.03	...	...	...	...	...	T	...	...	...	0.01	0.02	...	...	0.45	0.60	...	0.27	0.11	...	...	0 06	...	0.01	...	...	...	1.57
Ft. Madison	...	...	...	...	T	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1.85	...	...	0.10	...	...	...	0.10	0.10	...	...	...	2.15
Galva	...	...	...	...	0.05	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.01	...	...	0.25	...	...	...	0.01	...	...	...	...	0.32
Glenwood	...	...	...	...	0.12	0.02	...	...	...	...	...	...	...	...	...	...	T	...	...	0.27	...	...	T	...	...	...	0 05	0.03	...	...	...	0 49
Greenfield	...	...	T	...	0.05	...	...	...	T	...	T	...	T	T	T	...	...	...	T	0.33	...	T	0 40	...	...	...	0.07	0 06	...	...	...	0.91
Grand Meadow	...	...	T	...	...	0.15	...	...	...	...	...	...	...	...	0.03	...	...	...	...	0.70	...	...	0.05	...	...	...	...	0.25	...	...	...	1.18
Grinnell	...	...	0.01	...	T	0.05	...	...	...	...	...	...	...	T	T	T	...	...	0.60	...	...	...	0.25	...	...	...	T	T	...	...	...	0.91
Grundy Center	...	...	...	...	0.20	...	...	...	...	...	...	...	...	T	0.01	...	0.02	...	0.52	0.10	...	...	0.32	...	...	...	...	0.03	...	...	...	1.00
Hampton	...	...	T	...	0.24	...	...	...	T	...	...	...	...	...	...	...	...	...	0.32	0.03	...	...	0.35	...	...	...	...	0 11	...	...	...	1.05
Hawkeye	T	T	...	T	T	...	T	...	...	...	T	0.60	...	...	...	...	...	...	...	...	0.84	...	0.15	...	...	...	...	0 30	...	...	...	1.89
Hopeville	...	...	...	...	...	0.02	...	...	...	...	...	...	...	...	...	...	...	...	0.23	0.26	...	...	0.18	...	...	...	0.04	0.01	...	...	...	0.74
Hopkinton	...	...	T	...	...	0.10	...	...	...	...	...	...	...	...	...	...	...	...	T	0.50	...	...	0.60	...	...	...	...	0.10	...	...	...	1.30
Humboldt	...	...	...	...	0.30	...	...	...	...	...	...	...	...	...	0.01	...	...	...	...	0.30	...	...	0.40	...	...	...	...	0.20	...	...	...	1.21
Independence	...	...	...	...	T	T	...	...	...	...	...	...	...	...	...	...	...	T	...	0.35	...	...	0.32	...	...	...	...	0.20	...	...	...	0.87
Indianola	...	...	T	...	...	...	...	...	...	...	T	...	...	...	...	...	...	...	T	0.60	...	...	...	...	...	...	0.08	T	T	...	...	0.68
Iowa City	...	...	...	...	...	0.10	...	...	...	...	...	...	...	T	T	0.03	...	...	T	0.67	0.25	...	0.90	...	...	T	T	...	0 05	...	...	2.00
Iowa Falls	...	...	...	...	...	0.15	...	...	...	...	...	...	...	...	...	...	...	...	...	0.35	...	...	0.12	...	...	...	...	0.10	...	...	...	0.72
Keokuk	...	...	...	...	...	T	...	...	...	...	...	...	...	T	T	...	...	T	0.22	1.78	...	...	0.04	0.08	...	...	0.04	0.02	0 06	...	...	2.24
Keosauqua	...	...	T	...	...	T	...	...	...	...	...	...	...	...	T	T	...	...	0.20	1.24	...	...	...	0.02	...	T	0.06	T	...	...	...	1.52
Knoxville	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.20	0.40	...	...	0.30	...	...	...	...	T	...	...	...	0.90
La Crosse (Wis)	...	0.04	0.10	0.02	0.11	...	...	...	0.05	T	...	...	...	T	T	...	T	0.01	...	...	0.38	...	0.07	0.02	...	0.01	...	0.36	0.10	...	...	1.27
Larrabee	...	...	0.02	...	0.21	...	...	...	...	...	...	...	...	...	...	...	T	...	0.20	...	...	...	0.30	...	...	...	...	0 05	...	...	...	0.78
Logan	...	...	...	...	...	0 40	...	...	...	...	...	...	...	...	...	...	...	...	0.04	...	...	...	0.30	...	...	...	...	...	...	...	...	0.74
Le Claire	...	...	0.02	0.03	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1.32	...	0.06	0 33	...	...	...	0.01	0.04	...	...	...	1.81
Maxon	...	...	T	...	...	0.05	...	...	...	...	...	...	...	T	T	...	...	...	0 65	0.10	...	...	0.40	...	T	...	...	T	...	...	...	1.20
Mechanicsville	...	...	...	...	...	0.07	...	...	...	...	...	...	...	...	...	...	...	...	0 60	0.25	...	...	0.40	...	...	0.02	0.01	0.03	0.07	...	...	1.45
Monticello	...	...	T	...	...	0.05	...	...	...	...	...	...	...	...	0.02	0.02	...	...	T	0.61	...	...	0 30	...	...	T	...	0.08	...	...	...	1.08
Newton	...	...	T	...	T	0.04	...	...	...	...	...	...	...	...	...	...	...	...	T	0.34	...	...	0.31	...	...	...	...	T	...	...	...	0.69
Omaha (Neb)	...	...	T	...	0.01	0.09	...	...	T	...	...	...	...	...	...	...	T	0.01	0.03	0.17	T	T	0.15	...	...	...	0.05	T	...	...	...	0.51
Osage	...	...	0.05	...	...	0.20	...	...	...	...	...	...	...	...	...	...	...	...	0.25	...	...	...	0.05	...	...	...	...	0.20	...	T	...	0.75
Oskaloosa	...	...	...	...	0.10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.80	...	...	0.25	...	...	0.40	...	T	...	...	...	1.19
Ottumwa	...	...	...	...	...	0.05	...	...	...	...	...	...	...	...	...	...	...	...	...	1.75	...	...	0.20	0.05	...	...	0.05	T	...	...	...	2.10
Ovid	...	...	...	...	0 02	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.69	...	...	0.30	...	T	...	0.20	T	...	...	...	1.21
Panama	...	...	...	...	0.12	...	...	...	...	...	...	...	...	...	...	...	...	...	0.17	...	...	...	...	...	0.08	...	...	...	...	...	...	0.37
Richland	...	...	T	0.02	...	...	...	...	...	...	...	...	...	...	...	0.04	...	...	1.07	0.24	...	...	...	0.21	T	...	0.05	0.02	...	...	...	1.65
Rockwell City	...	...	...	...	0.19	...	...	...	...	...	...	...	...	...	T	...	...	...	0 36	...	...	...	0.20	...	...	...	...	...	...	...	...	0.75
Rock Rapids	T	T	...	...	0.30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.15	0.15	...	...	...	...	...	T	0.05	...	...	...	0.65
Sac City	...	...	0.05	...	0 30	...	...	...	...	...	...	...	...	...	...	...	0.10	...	0.30	...	...	...	0.40	...	...	...	...	...	...	...	...	1.55
Seymour	...	...	...	...	...	T	...	...	...	...	...	...	...	T	...	...	...	...	T	0.67	...	...	...	0.20	...	T	0.30	...	...	...	...	...	1.17
Sibley	...	...	0.40	...	T	0.12	...	...	...	...	...	...	...	...	...	...	...	...	T	0.25	...	...	0.20	...	...	...	...	T	...	...	T	0.97
Sioux City	...	...	T	...	0.01	0.06	...	...	...	...	...	...	...	...	...	...	T	...	0.04	0.14	...	...	0.25	...	...	T	T	0.10	...	...	T	0.60
Spirit Lake	...	...	T	...	T	...	...	...	...	...	...	...	...	...	...	...	T	...	...	0.20	...	...	0.60	...	...	...	...	...	...	...	...	0.80
Tipton	...	...	...	...	...	0.04	...	...	...	...	...	...	...	...	...	...	...	T	T	1.20	...	...	0.32	...	...	0.04	0.02	...	...	...	...	1.62
Toledo	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.42	...	...	0.30	...	...	...	...	...	...	...	...	0.72
Villisca	...	...	...	...	T	...	...	...	...	...	...	...	...	...	...	...	...	...	0.51	...	...	0.02	0.30	...	...	0.10	...	T	...	...	...	0.93
Vinton	...	...	...	...	0.05	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.28	...	...	0.50	...	...	...	...	0.05	...	...	...	0.88
Washington	...	...	...	T	...	T	...	...	...	...	...	...	...	...	...	...	...	...	...	0.74	...	...	...	0.24	...	0.04	0.08	T	...	...	...	1.10
Webster City	...	...	T	...	0 25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.50	T	...	0.25	...	...	...	...	0.12	...	...	...	1.12
West Bend	...	...	T	...	0.03	...	...	...	...	...	...	...	...	...	...	...	T	...	0.10	...	T	...	0.20	...	...	...	T	0.30	...	...	...	0.90
Williams	...	...	...	...	...	0.22	...	...	...	...	...	...	...	...	...	...	...	...	0.35	...	...	0.20	...	...	...	...	...	0.10	...	...	...	0.87

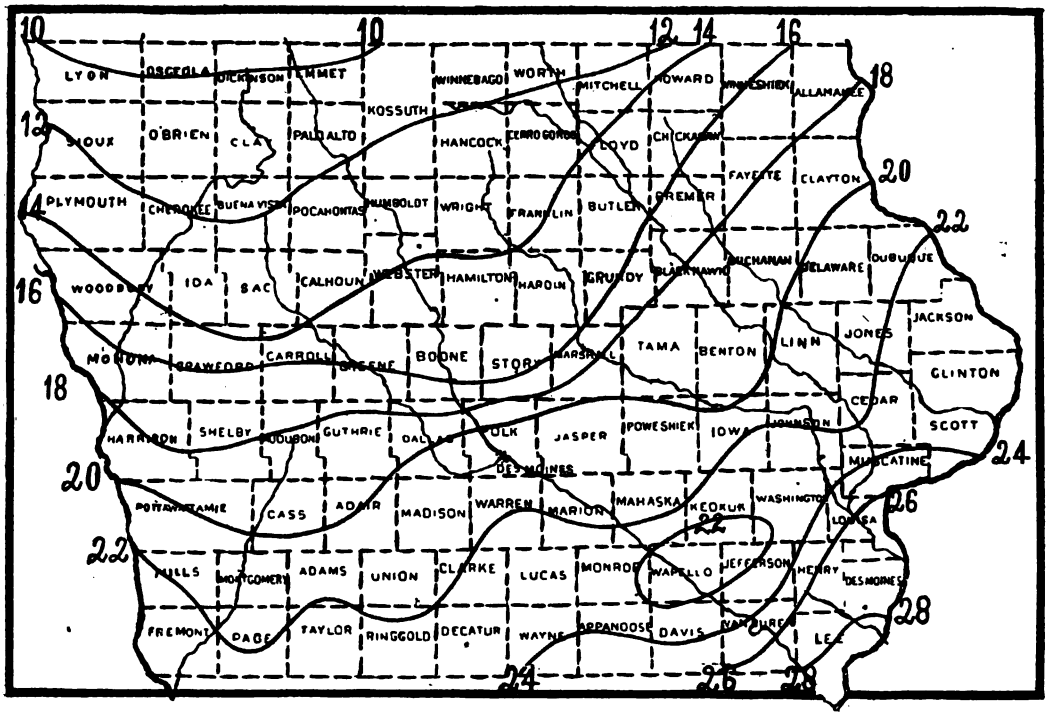
MAXIMUM AND MINIMUM TEMPERATURE FOR JANUARY, 1894.

| STATIONS. | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | | 9 | | 10 | | 11 | | 12 | | 13 | | 14 | | 15 | | 16 | | 17 | | 18 | | 19 | | 20 | | 21 | | 22 | | 23 | | 24 | | 25 | | 26 | | 27 | | 28 | | 29 | | 30 | | 31 | | Mon'y Mean. | |
|---|---|---

IOWA PRECIPITATION CHART JAN. 1894.



MEAN TEMPERATURE JAN. 1894



METEOROLOGICAL STATIONS AND OBSERVERS.

From the following, weekly and monthly reports of Meteorological data are received by the Iowa Weather and Crop Service.

Albia	Gus Johnson.
Algona	C. D. Pettibone.
Alta	D. E. Hadden.
Amana	Conrad Schadt.
Ames	E. C. Dickinson.
Ames	Fred L. Kent.
Atlantic	J. W. Love.
Audubon	J. F. Hocker.
Belle Plaine	H. W. Vandike.
Blakeville	James Rodgers.
Blockton	C. W. Thompson.
Bonaparte	Hon. B. R. Vale.
Carroll	Moses Simon.
Cedar Falls	Prof. A. C. Page.
Cedar Rapids	H. D. Olds.
Centerville	Prof. H. E. Reister.
Charles City	J. W. Smith.
Clarinda	A. S. Van Sandt.
Clinton	Luke Roberts.
College Springs	A. A. Berry.
Corning	John W. Bixby.
Cresco	Gregory Marshall.
Council Bluffs	E. W. Hart.
Davenport	*F. J. Walz.
Delaware	Wm. Ball.
Decorah	L. H. Baker.
Denison	M. E. Lies.
Des Moines	*Geo. M. Chappel, M. D.
Dubuque	*S. C. Emery.
Eagle Grove	C. A. Schaffter.
Eldora	Prof. C. F. Woodward.
Elkader	Chas. Reinecke.
Fairfield	J. Fred Clarke, M. D.
Fayette	R. Z. Latimer.
Ft. Madison	Miss L. A. McCready.
Fulton	J. W. Eckles.
Galva	W. A. Crowley.
Glenwood	Seth Dean.
Greenfield	J. G. Culver.
Grinnell	Prof. S. J. Buck.
Grundy Center	Chas. G. Rogers.
Hampton	E. C. Grenelle.
Hawkeye	J. W. Bopp.
Hopeville	M. T. Ashley.
Hopkinton	Theo. Marks
Humboldt	J. W. Foster.
Independence	E. F. Wulfke.
Indianola	Prof. J. L. Tilton.
Iowa City	Prof. A. L. Arner.
Iowa Falls	J. B. Parmelee.
Jefferson	Dr. Chas. Enfield.
Keokuk	*Fred. Z. Gosewisch.
Keosauqua	Prof. J. H. Landes.
Larrabee	H. B. Strever.
Logan	Mrs. M. B. Stern.
Mason City	H. I. Smith.
Marshalltown	L. S. Kilborn.
Maquoketa	Dr. A. B. Bowen.
Mechanicsville	Rev. J. W. Hubbard.
Mooar	F. G. Thomas
Monticello	Henry D. Smith
Mount Vernon	Prof. A. Collin.
Mt. Ayr	Hon. Wm. Shriver.
Murray	A. W. Lewis.
Muscatine	J. P. Walton
Newton	A. Lufkin
Omaha, Neb	*Geo. E. Hunt.
Ovid	H. C. Miller.
Osage	G. D. Pattingill
Oskaloosa	Jos. Boyd.
Panama	Wm. J. Wicks.
Postville	F. L. Williams.
Richland	Wm. A. Shaffer.
Rock Rapids	W. C. Wyckoff.
Rockwell City	G. B. Rigg.
Seymour	Mrs. C. A. Conger.
Sibley	H. G. Doolittle.
Sidney	G V. Swearingen.
Sioux City	*U. G. Pursell.
Sac City	Dr. C. Brown.
Spirit Lake	H. C. Drummond.
Storm Lake	A. J. Bond.
Tipton	J. M. Rider.
Toledo	Chas. Mason.
Vinton	T. F. McCune.
Villisca	M. M. Stoddard.
Washington	Wm. A. Cook.
Webster City	C. M. Trumbauer.
Winterset	Will McKnight.
West Bend	Phil. Dorweiler
Williams	M. L. Fuller

*U. S. Weather Bureau.

WEATHER-CROP OBSERVERS.

Reporting for the Weekly Bulletin.

Afton	M. V. Ashby.
Agency	J. H. Van Zant.
Albia	Wm. Mercer.
Alta	Hon. H. T. Saberson.
Ames	Henry C. Wallace.
Anita	H. T. Chapin.
Ankeny	Ed. Parmenter.
Battle Creek	A. Preston.
Bloomfield	Geo. Duffield.
Boone	L. C. Morris.
Carbon	N. M. King.
Carson	G. N. Ferguson.
Centerville	Henry Galley.
Charles City	W. B. Towner.
Chariton	C. C. Burr.
Clarksville	F. M. Russell.
Corning	Jerome Smith.
Clermont	Chas. Larrabee.
Concord	J. M. Elder.
Council Bluffs	L. Prouty.
Dedham	J. W. Kay
Danville	Sherman Matthews.
Emerson	D. B. Nims.
Ely	Hon. A. J. Fuhrmeister.
Fontanelle	W. H. Bridgman.
Ford	W. W. Whitmore.
Fort Dodge	R. W. Blaine.
Geneva	Wm. H. Thompson.
Gosport	B. F. Banta.
Grand River	Dr. John Daykin.
Grinnell	A. O. Price.
Harlan	Fred Fischer.
Hesper	G. E. Dillingham.
Hodge	James Piper.
Hamlin	F. P. Moore.
Humeston	Hon. S. H. Moore.
Independence	C. L. Thomas.
Indianola	T. B. Hammer.
Jefferson	S. M. Taylor.
Larrabee	H. H. Carnahan.
LeMars	Hon. Henry Schrooten.
Ledyard	Frank Miller.
Lawler	Hon. Wm. Glattly.
Lockridge	John F. Farman.
Manning	H. W. Pollock.
Mapleton	A. Lamb.
Marshalltown	Hon. J. G. Brown.
Mason City	Wm. Nettleton.
Mt. Pleasant	W. S. Wright.
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Winterset	H A. Kinsman.
Wall Lake	F. E. Wilcox.
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What Cheer	O. D. Lawrence.

Met. 217

UNITED STATES DEPARTMENT OF AGRICULTURE

WEATHER BUREAU.

MONTHLY REVIEW

OF THE

Iowa Weather and Crop Service.

VOL. V.—FEBRUARY, 1894.—NO. 2.

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CENTRAL STATION, DES MOINES, IOWA.

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DIRECTOR.

GEO. M. CHAPPEL, M. D.,
LOCAL FORECAST OFFICIAL,
U. S. WEATHER BUREAU, ASS'T DIRECTOR.

DES MOINES:
G. H. RAGSDALE, STATE PRINTER.
1894.

THE IOWA WEATHER AND CROP SERVICE

Was established by act of the Twenty-Third General Assembly, and placed under supervision of the Board of Directors of the State Agricultural Society, constituted as follows:

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MONTHLY REVIEW

OF THE

IOWA WEATHER AND CROP SERVICE.

VOL. V.] FEBRUARY, 1894. [NO. 2.

EDITORIAL NOTES.

The issue of Weather-Crop Bulletins will begin about April 9. Blanks will be forwarded to observers before that date, and we earnestly solicit all who receive them to serve during the season of 1894. It is a gratuitous work, but it brings a full measure of compensation to those who are brim full of public spirit and a desire to be useful to their fellow citizens. After all, we sometimes derive the highest degree of satisfaction from work for which no reward is received in dollars and cents.

***

Prof. Foster, one of the long-range weather prophets, professes to have discovered by reading the stars, that during March, 1894, unusually heavy rains or snows will fall in many parts of the country, and floods may be expected. That is a reasonably safe forecast. March is usually a stormy month throughout this continent, bringing every year heavy rains, snows, floods, windstorms, blizzards, and even tornadoes somewhere within the wide expanse of the United States and Canada. So look out for big storms about these days, as the almanacs used to say, and wherever a big one appears it will have Prof. Foster's trademark blown on the bottle. Thus readeth the stars, which in their courses are legible only to the few favored weather seers of the planetary school.

***

McClure's Magazine for February contains an interesting article relating to the scientific observatory recently erected on the summit of Mt. Blanc, under the direction of M. Janssen, the eminent French astronomer. The article gives an exposition of the momentous scientific problems which it is hoped this high observatory will do much toward solving.

***

An inch of rain signifies half a gallon of water to every square foot, or something over one hundred tons to every acre.

A Russian scientist, with an unpronounceable name, maintains that meat may be cooked by extreme cold as well as by heat; that is to say, almost precisely the same chemical and physical changes can be accomplished by freezing as by the application of heat.

***

In March the prudent man sheds his live stock, but not his flannels.

***

The Weather Bureau in its review of weather crop conditions during the month of February says: The month of February was colder than usual throughout the entire country except in Southern Florida and portions of Northern Minnesota and North Dakota, where about the normal temperature prevailed. In that portion of the country east of the Mississippi the mean temperature of the south was about 3 degrees more than usual for February, while from the Mississippi westward over the Rocky Mountains and plateau regions the deficiency in temperature ranged from 5 to 10 degrees. On the Pacific coast the deficiency for the month ranged from 3 to 6 degrees. The first half of the month was warm in all districts east of the Rocky Mountains, while the last half was colder than usual in all districts, the last week of the month giving temperatures decidedly below the normal from the plateau region eastward to the Atlantic coast. During this week the most extended cold wave of the month occurred and carried the line of freezing weather to the Gulf coast, and this was attended by unusually heavy snows from New York and Southern New England southwestward to Northern Alabama and Central Georgia, the month closing with snow on the ground over the northern portions of the South Atlantic and Gulf States.

***

Secretary Morton is said to have recently made the the statement that the U. S. Weather Bureau, had within the preceding four months, saved to the business interests of the country a greater sum of money than the

appropriation estimated for the maintenance of the Service during the ensuing fiscal year.

***

An English paper says no progress has been made in recent years in that country in the production of meat, and the comparative consumption of imported meat is continually increasing.

***

Prof. Newell, of the United States Geological Corps, in his recent report on the quantity of water available for irrigation of the arid lands of the west, says: "It does not appear probable that even as high as 10 per cent of the land now owned by the government can ever be irrigated. In fact there is not a sufficient supply of water to bring under cultivation an area equal to that which has passed into the hands of individuals and corporations. There are, however, localities where thousands of acres can be profitably irrigated by the construction of expensive dams and irrigating canals."

***

Terrible stories are told of the Russian thistle, for the extermination of which the government is asked by a North Dakota senator to appropriate $1,000,000. The pest was taken to North Dakota in the seed grain of some Muscovite immigrants, and has spread within a few years over the Dakotas, Nebraska, Iowa, Minnesota and northern Wisconsin. It is a plant of astonishing vigor and fecundity, growing up and out rapidly "to the size of a sod cabin," shading surrounding crops and monopolizing the moisture and nutrition of the soil, and then scattering its seed far and wide on every wind. So tough and poisonous are its prickles that men and animals are said to be compelled to wear sheet iron bootlegs in passing through the thistle fields, and it is related that in Siberia the plant has simply conquered large stretches of land and driven agriculture away from it. Heroic measures are demanded to cope with this scourge, says Senator Hasbrough, and if all that is said is true, such is certainly the case.—*Produce Exchange Reporter.*

***

A recent commercial circular of Clapp & Co., N. Y., says: "Crop prospects at this season have seldom been reported more flattering. England's reports predict a shortage in 1894 from the 1893 acreage of 320,000 acres, and a yield of 49,250,000 bushels, and ample supplies for the present, and liberal offerings from Australia, Argentine, India and Russia at prices never before prevailing and below our offers. The three last shipped 50 per cent more since August 1 than in previous year, and for early weeks of 1894 about seven-ninths as much as the United States and Canada. India never stored as much or carried as much over from one crop to another. Yearly for four years past our acreage has decreased. It's now about 14 per cent less than in 1890, showing a decrease equal to three and a half times that of the United Kingdom's present acreage (England now grows more acres of oats than wheat). The Illinois report claims the State has seeded but 1,824,427 acres against 2,029,000 in fall of 1892. California reports good rains and very promising prospects, with full average stocks of old wheat left over. The fall acreage for the twenty-four winter states was reported to be 21,079,300 acres."

***

The *American Agriculturist* advises farmers to reduce their wheat acreage at least 20 per cent. It says Europe consumes more rye than wheat; that it can be grown as cheaply, and yields two or three more bushels per acre.

***

B. F. Tillinghast, in *Davenport Democrat:* "Iowa still holds my allegiance. In most things that makes life worth living it is the first and best of the forty-four states. From the Mississippi to the Missouri its earth is most certain, when stirred with the plow, to laugh with abundant harvests. It has no barren fields. It is alive with a people who progress, and as a matter of course who think and read. For grain growing, stock raising and prairie beauty; for schools and churches; for industry and rewarded energy, Iowa is a paradise. I like it above other states for three-fourths of the year. During the first quarter—January, February, March—Iowa may be profitably left to the fitful winds, snows, rains; to the freezes and thaws; the ice and mud; the sudden and severe changes which no man can foretell, prevent or escape. That is to say, he cannot fortify himself against the blizzard and remain in the latitude of Davenport and Omaha. But he can in a few hours come to summer suns and bright skies. This will make him more appreciative of Iowa springtime, autumn and early winter. Thousands have learned, and others will do so in time, that nature's favors have not all been strewn in one section, either north or south, and to enjoy them is to migrate with the birds."

***

Scientific experiments seem to prove that the amount of nitrogen compounds supplied to the soil by precipitation varies from month to month and from year to year. The average richness of meteoric waters reaches its minimum in June and July, and attains its highest point in February and March. Gentle precipitations in form of mist, frost and snow are much richer than rain, reaching occasionally five times the general average of the latter. This fact is the basis of the old proverb, that snow in the spring time is the poor man's fertilizer.

***

J. L. Hills, of the Vermont experiment station, recently made an investigation of the effect of weather upon the quantity and quality of milk. The results indicate that when cows were at pasture the quality of the milk varied with the temperature, becoming richer as the temperature fell and poorer as it grew warmer. The same variations were found to be true of the total solids, and of the solids-not-fat. Violent changes in temperature tended to diminish the quantity of milk. Rain storms, unless very heavy, appeared to have no noticeable effect on either quantity or quality of milk. Mr. Hills concludes: "We have not been able to discover any more plausible theory for this tendency of the cow's nature than that during cold

weather the cow actually consumes more food, and thus there is present in the system a larger amount of material from which to produce richer milk."

***

Prof. Alexander Graham Bell, of telephone fame, is reported in a recent interview to have declared his belief, amounting almost to conviction, that the flying machine would be an accomplished fact before the end of the century, at most before the end of ten years. This great undertaking, he said, was no longer in the hands of "fakirs;" it was engaging the minds of practical scientists like Maxim, the inventor of the Maxim gun, and Professor Langley of the Smithsonian Institution. The great difficulty in the past was that inventors were on the wrong track. They had been vainly trying to make a flying machine on the principle of the balloon—lighter than the air. Such a machine could never be properly steered. The flying machine of the future would have greater specific gravity than the air. Of this Professors Langley and Maxim were convinced, and on this principle one or both will soon succeed. The machine need not have wings. Nature was not always a wise guide; the steam locomotive got on well without legs. Indeed, the rotary motion was the most economical.

***

Pastures which show damaging effects of the winter should be looked after early in the spring, and the defective stand should be reinforced by a liberal seeding of blue grass and clover.

***

The Farmers Mutual Hail Insurance Association of Iowa was organized March 4, 1893. Secretary W. A. Rutledge, of Early, writes us that its first season's experience was highly satisfactory and encouraging. Its first policy was issued May 17th, and during the two and a half months following that date the association issued policies to the enormous amount of $1,361,000. Losses from hail connected with the great storm which culminated in the Pomeroy tornado amounted to nearly $4,000, and the losses for the season aggregated $7,000, all of which were paid by an assessment of three-fourths of one per cent, or less than three cents per acre upon the total acreage of crops covered by policies. This is indeed a most flattering record, attesting the beneficence of such an association and showing that it has been wisely administered. There can be no question as to the value of such an agency, whereby the farmers of Iowa may bear each other's burdens and distribute the losses of crops occasioned by that most damaging class of summer storms. When such losses are fairly distributed they are very light, but upon the individual farmer they sometimes fall with crushing weight.

BLOSSOM STORMS.

The flowers of the orchard and fruit garden are, as a rule, dependent upon the visits of insects (bees, etc.) for the transfer of their pollen from one blossom to another. Storms prevent insects from making such visits in search for nectar and the pollen is not properly distributed; this pollen, instead of remaining inactive, may be washed out of the flower and lost, thus depriving the blossoms of the needed amount of fertilizing dust; in the third place, the pollen may, on account of the excess of moisture, undergo a growth that will render it worthless for impregnation when the warm, sunny days come and the bees are ready to transfer it. It is possible that a storm may serve to thin out the fruit of an overloaded tree before the flowers have "set" and thus be a real benefit, but on the other hand a storm is able to work much harm. The unfavorable results of long "blossom storms" only emphasize the fact that the spraying of plants while in bloom, interferes with the activity of the insects, but most of all because the poison used may injure the pollen and the young fruit by contact. Bear in mind that the flower is a delicate structure, and if rain water can do injury any substance designed to destroy life will all the more prove harmful.

B. D. HALSTED.

THE NORTHERN LIGHTS.

BY W. E. THARP, STUART, IOWA.

A few evenings ago a fine auroral display appeared in the northern heavens. About 9:00 o'clock a low arch of diffuse light spanned the horizon, its lower edge being quite distinct, contrasting strangely with the dark segment of sky beneath. The whole arch gradually became more luminous, as parts of it would glow and fade like the reflection of distant lightning upon the clouds. Then long streamers appeared, shooting up almost to the zenith. Some were dull and indistinct, others bright, expanding beams, the upper extremities of which were tinged with red. At the bases of the arch these vertical streaks broadened into cloud-like forms that approached in color the tints of the sunset. For some time in the northeast and northwest were tall, columnar clouds of crimson forming a striking spectacle. The moon rose a few degrees south of the northeast one. Then the heavens presented a unique appearance, as though the flaming heralds of the morning had quitted their attendance upon the sun and come up from the depths of the north to witness the quiet beauty of the queen of night.

Soon, however, all traces of the aurora disappeared, but the next night there was an even grander display. Two distinct arches could be seen; the lower bright and well defined, the one above broad and diffuse. For an hour or more these changed constantly. While one part faded almost entirely another would brighten. The arches became one broad belt of light, then broke into pieces, which seemed to be part of three concentric arcs. Finally all semblance of continuity disappeared, and the fragments, or at leaast many of them, began to glow, then burst into streamers of quivering light, some of them reaching to the zenith. So bright and close together were these vertical striæ that they had some resemblance to a curtain of fine silk, invisible except where the observer saw several folds. The points were tinged with red, and this was particularly noticeable in those streamers which flamed up to the zenith. This lasted but a short time,

then gradually faded away and the sky resumed its usual appearance.

In our latitude the aurora is always seen in the north. It generally consists of a more or less distinct arch, not many degrees above the horizon, while the segment of sky beneath is very dark. This is not a cloud, for faint stars are visible through it. It is due to a hazy condition of the atmosphere, ordinarily unnoticeable, except possibly near the horizon. Beneath the arch it appears darker by contrast with the light above.

From the great number of observations made in the last half century we have many facts, and also not a few beautiful theories, in regard to these wonderful phenomena. As we travel northward the annual number of auroras increase in frequency and brilliancy, until between the 50th and 60th parallels they occur almost every night. Beyond this they decrease in number, and are always seen in the south. This is true of any longitude. Thus the region of auroral display is a zone, or ring, surrounding the magnetic pole.

The arch itself may be regarded as a circle parallel with the earth's surface. Seen by an observer far in the south, the "edge" of the ring would appear as a low arch, this being the effect of perspective. Occasionally the most of the circle has been seen, when, of course, it appeared as an ellipse.

From simultaneous measurements made on different degrees of latitude, the height of the auroral arch and beams has been estimated. The lower edge of the arch is seldom nearer the surface than forty-five or fifty miles, while the streamers sometimes attain an altitude of five hundred miles. The beams are not perpendicular, but nearly parallel with the dipping needle. Their colors are the same as those produced by passing an electric current through rarified air. No doubt but the atmospheric vapor, by its refractive power, modifies the auroral light, as it does that of the sun and moon.

What is the cause of these flaming lights of the north that seem to be designed especially to illume the long, sad arctic night, and excite the wonder of the inhabitants of more favored regions? We do not know. They are, however, electrical phenomena. A surprising sympathy exists between sun-spots, auroras, and magnetic needle disturbances. The telegraph and compass are greatly affected during the brilliant displays in the high northern latitudes.

Evaporation produces most of the atmospheric electricity. Vapor is positive, and in clear weather, the atmosphere is positively electrified. In the tropical and temperate zones the frequent thunder storms and greater humidity of the air tend to restore the equilibrium. These conditions do not exist in the polar regions.

There is comparatively little condensed vapor to serve as a conductor. The electricity of the vast quantities of vapor brought thither by the return Arctic currents manifests itself by other means and through a different medium. If electricity escape from a metallic conductor under the receiver of an air-pump to the pole of a magnet it will form a ring around the pole. The discharge of electricity from the higher regions of the atmosphere is controlled by the earth's magnetism. The arch and the forms and movements of the streamers may be explained by established facts in electrical science. But it is improbable that we will have any satisfactory explanation of this beautiful phenomenon until terrestial magnetism is better understood.

THE GEOLOGICAL MAPPING OF IOWA.

BY DR. CHARLES R. KEYES, ASSISTANT STATE GEOLOGIST.

In the construction of a geological map of a region the geologist has in view the location of the exact boundaries of the different formations. The latter have a particular arrangement and definite relations with one another. The classification is such that when any one of the geological subdivisions is referred to, its exact place in the system is at once known. Each geological formation has its peculiarities and its useful deposits.

Most of the stratified rocks were originally laid down nearly horizontally. In the course of time, however, they became tilted, folded or broken, so that now they seldom present their original evenness. Furthermore, erosion has acted more or less vigorously on all land surfaces, and as the process of destruction goes on, one layer after another is cut through by the rivers until the edges of several or of many formations may be represented in the sides of the valleys. Since each formation contains its own particular deposits of useful substances, which are usually confined to one or a few formations, it becomes a matter of prime importance to have the characters made out by which the separate divisions may be distinguished from one another. This determination falls to the geologist. Having once made out carefully the distinguishing features of a given formation he can readily recognize even by small fragments of rock picked up here and there which formations are to be expected and which not. If it is coal that is wanted, a glance at the ledge exposed by a small stream will tell whether or not the coal bearing rocks are present, and whether or not it is worth while to look for workable deposits below. In the same way the lead and zinc bearing formations may be recognized when none of the mineral itself is visible; and on the other hand, when samples of these metals are picked up it may be told at once whether or not they came from the formations which yield the substances in paying quantities. The inability of most people to distinguish these facts leads to the useless expenditure of many thousands of dollars each year. Now, it is the duty of the geologist, after having studied the different formations so as to be able to recognize them to represent on suitable maps the areas where they are exposed at the surface. Further, the general arrangement of the rocks is shown so that it may be known, in case a certain mineral bearing horizon does not appear at the surface in a given district, just what layers must be penetrated, and the distance it is necessary to go in order to reach the more useful beds.

Thus, a systematic investigation and the mapping of a region by experienced persons puts in the hands of the

citizens of each district the means by which each will know just what he may expect to find and what it is useless to search for. This is the chief aim of a properly conducted geological survey. By the expenditure in each county of a few hundred dollars information is obtained which, if acquired in the ordinary manner, would cost ten, twenty or many more times as much. In addition each one has the information as obtained by a disinterested person and under the official guaranty of the State.

A modern geological map is a graphic summary of a vast mass of useful information. In addition to an accurate representation of the ordinary geographical features, as in the best atlases, a properly constructed geological map records much more. On it is indicated, within a few feet, the elevation above the sea level of every point within the compass of the area; the drainage basins and the water powers are noted; the distribution and limits of the different geological formations are plainly marked; the various kinds of ores, building stones, clays and all minerals of economic value contained in the several beds are located; the best places for obtaining all these substances are indicated. The map also forms a reliable soil index.

The construction of a full set of maps of this character is not the work of a few days or a few weeks, but the labor of several years. In connection with the investigations of the economic resources of the state there is contemplated a series of maps which shall embrace for every part of the state all the information above mentioned. Some of them will be somewhat general in their nature, and will accompany the different special reports. Others will be more detailed in their make-up, and will cover given counties or such areas as may be thought desirable. In the construction of maps showing the distribution and occurrences of mineral substances it is of prime importance that the surface relief should be depicted in a readily intelligible manner. One which represents most closely a perfect miniature of the surface of the region is far superior to any ordinary atlas. It is invaluable not only to the trained geologist, but it is about the only practical way by which the average citizen is able to comprehend at a glance the explanations. In proportion as the exactness with which the diminutive representation approaches the actual surface, in the same proportion does the usefulness of the work increase. The modern methods of making maps are so far advanced over those of a quarter of a century ago that there is no excuse for a community to be without the best.

The accompanying geological map of Iowa is one which was made to go with the report recently issued by the survey on the coal deposits of the state. It is on too small a scale to represent all the minor formations and consequently only the larger subdivisions are indicated by the different colors. In the final map of the state it is expected that the size will be about three by four feet.

In this place only the more salient features of the map can be considered. In acquiring a knowledge of the various mineral deposits of a region, an accurate understanding of the distribution of the several geological formations is of the greatest importance. In Iowa the sequence of strata is measurably complete. Over all the hard rocks there spreads a thick mantle of unconsolidated drift material which greatly increases the natural difficulties in the study of the stratified beds. The complete section of the rocks of Iowa indicate a thickness of at least five thousand feet.

The Algonkian rocks (represented by the scarlet color) occupy the extreme northwestern corner of the state. At the present time they are regarded as the oldest deposits having a surface exposure within the limits of Iowa The formation is locally called the Sioux quartzite or Sioux granite. It is chiefly a vitreous, jasper-like rock with occasional sand layers intercalated. It forms one of the most durable building stones known and occurs in exhaustless quantities in Lyon county and adjoining portions of Dakota and Minnesota.

In the extreme northeastern corner of the state occurs the next oldest formation, the Cambrian (represented by the carmine on the map). It is known to have a maximum thickness of not less than one thousand feet. For the most part it is an unconsolidated sand bed and wears away rapidly under the influence of the weather. In some places clay seams and thin layers of limestone rocks are developed. In the neighboring states the calcareous and argillaceous beds assume much greater importance and form shales and shaley limestones. Building stones and a very pure sand suitable for the manufacture of glass constitute its chief economic value.

The Silurian rocks of the state (occupying the area colored pink) make up a large portion of eastern Iowa, from Davenport northward to the Minnesota line. There are seven minor subdivisions. At the base is the Oneota limestone, which furnishes an excellent quality of building stone and lime, and also some lead ore. Overlying it is the Saint Peter sandstone, which supplies large quantities of very pure sand, well adapted for the manufacture of glass. The Trenton limestone comes next, parts of which form a very durable building material, and is largely quarried. A very good quality of lime is also manufactured from this stone. The clay shales separating the limestone beds, afford excellent material for the manufacture of light colored brick. In the Galena limestone are found the ores of zinc and lead which have been so extensively mined since the earliest settlement of the Upper Mississippi Valley. The Maquoketa shales may be utilized in the manufacture of brick and pottery. The Upper Silurian limestone, comprising the Le Claire and Niagara, supplies unlimited quantities of fine building stone and also furnishes the best lime in the world.

The Devonian rocks (purple area) contain some of the most important deposits of the state. West of the Silurian area in Iowa there is a broad area extending in a belt thirty to forty miles in width from the mouth of the Iowa to the Minnesota line. Wherever the rock is exposed good building material can be readily obtained. In the northern part a fine grade of plastic clay exists, forming a valuable material for the manufacture of brick. The different formations represented are the Independence shales, the Cedar Valley limestone, Montpelier sandstone and the Lime Creek shales.

Beyond the margin of the Denovian come in the Lower

Carboniferous rocks (blue area). The formation is made up chiefly of limestone, and extends in a narrow belt from the southeastern corner of the state northwestward to Minnesota. The limestone furnishes a good grade of building stone, and some of the best paving bricks in the west are made from portions of the shale. There are three formations, the Kinderhook, Augusta and St. Louis.

The Upper Carboniferous formation (brown area) occupies a broad triangular area, having the south state line for its basal boundary, and its apical portion reaching into north central Iowa beyond Ft. Dodge. Economically, it contains the most important mineral deposits in the state. As it is now recognized in Iowa this series is divided into the Missouri stage, corresponding to the upper coal measures, and the Des Moines stage, corresponding to the lower coal measures. The chief portion of the formation is therefore made up of the productive coal measures which form Iowa's greatest source of mineral wealth. Besides the coals there are beds of valuable clays which are practically exhaustless, and capable of supplying the world with all the clay products that can be manufactured for ages to come.

The Cretaceous (green area) occupies a large area in the northwestern quarter of the state. The different formations are the Nishanabotna sandstone, the Fort Dodge beds, Woodbury shales and the Niobrara chalks. Besides the great gypsum deposits near Fort Dodge this formation contains unlimited quantities of good materials for the manufacture of Portland cement; also clays and some building stone. There probably exists also valuable beds of brown coal. Some of the seams are known to be upwards of four feet in thickness.

The drift or glacial covering which mantles the entire state is not for obvious reasons represented on the map.

EARTH MOVEMENTS.

That the earth is breathing, that the tall buildings upon its surface are being continually moved to and fro like the masts of a ship upon an ocean, are at present facts which have received but little recognition, states Professor John Milne in *Nature*. In few countries only are earthquakes of sufficient frequency to make them worthy of serious attention. But there are earth movements that are being experienced at all times and in all lands, our continents being surfaces with a configuration that is always changing. It is these movements that are now to be studied by physicists. In Germany and Japan a tide-like movement, too great to be produced by lunar attraction, has been observed, the ground being gently tilted every twenty-four hours (more at night than by day), and buildings and chimneys slightly inclined like stalks of corn in a steady breeze. It is suggested that in Japan this movement may be due to the opening and shutting of the crumbled strata forming a range of mountains. Among the other movements of our panting earth are the microseismic or tremor storms, which are now defined as long, flat waves, like those of an ocean swell, and the bending effect produced in certain districts by changes of atmospheric pressure. There are also waves from distant earthquakes, which are appreciable to the senses for only a few hundred miles, but which may extend around the world.

THE VALUE OF WEATHER OBSERVATIONS.

[BY PROF. T. RUSSELL, WEATHER BUREAU.]

Observations have a two-fold object: First, to obtain a knowledge of the climate of a region, that is the average of the various air conditions over a country that affect the convenience, comfort or health of the people, or influence plant growth: second, the discovery and improvement of rules and methods for making weather predictions. For this purpose the observations over an extensive area of country are used to trace the origin, direction and rate of progress of pressure and temperature changes in the air, the occurrence of rainfall, and the direction and velocity of wind as dependent on the variety in distribution of pressure and temperature over a region.

The successful predictions of the principal weather changes, such as cold waves, storm winds, heavy rainfalls, and great river floods are of the highest practical value to people. The attainment of this important object, even with only a partial degree of success, is a sufficient motive for the labor bestowed in making and preserving the vast amount of weather observations now going on in most countries all over the world.

Observations are desired in at least one place in every county of every state in the United States. For the purpose of procuring these observations the Chief of the Weather Bureau is authorized by law to loan instruments to observers desirous of making the observations, but on certain conditions. These conditions are the safe keeping and return of instruments, and that a copy of the observations be furnished to the Weather Bureau Office, Department of Agriculture at Washington, D. C., free of expense to the United States Government.

Ordinary precautions are required in the use of instruments. Observers are not, however, held responsible for the breakage or loss of instruments due to unavoidable accidents incident to their use in the making of observations.

The observations in which the Weather Bureau is most interested are rainfall and temperature. Thermometers and rain gauges are furnished to the observers free of any charges for instruments or for transportation to the observers.

Blank forms and franked envelopes are furnished to the observers for transmission of reports to Washington, D. C., free of expense to the observer. Observers are also furnished with a copy of the *Monthly Weather Review*, an official publication which gives a summary of the weather all over the United States for each month, the mean temperatures and total rainfalls for places, descriptions of progress of principal storms, cold waves and floods during the month, etc.

Voluntary observers are not furnished with barometers, wind vanes or anemometers. Many of the observers have these instruments, their own private property, and instructions are, therefore, given regarding their use and care.

Observations of air pressure and wind velocity by voluntary observers are not desired by the Weather Bureau. Enough data of this nature for the purposes of the Bureau, the forecasting of weather, are obtained from the regular meteorological stations. Observations of pressure by voluntary observers are mainly of interest to the observers themselves at the time of the observation in estimating the location of storm centers in vicinity where there is no access to the daily weather map issued by the Weather Bureau. The detailed or average values of pressures are of little value for climate. The rainfall and temperature observations are intended to be used in the Weather Bureau in working up the climatology of the whole country.

A trustworthy record of the weather is always of interest to a community, and is often of very great practical value. It is one of the objects of the Weather Bureau to foster and encourage the keeping of such records. There are numerous calls for records of the weather as evidence in courts in important law cases, months and even years after the record is made. Contract-

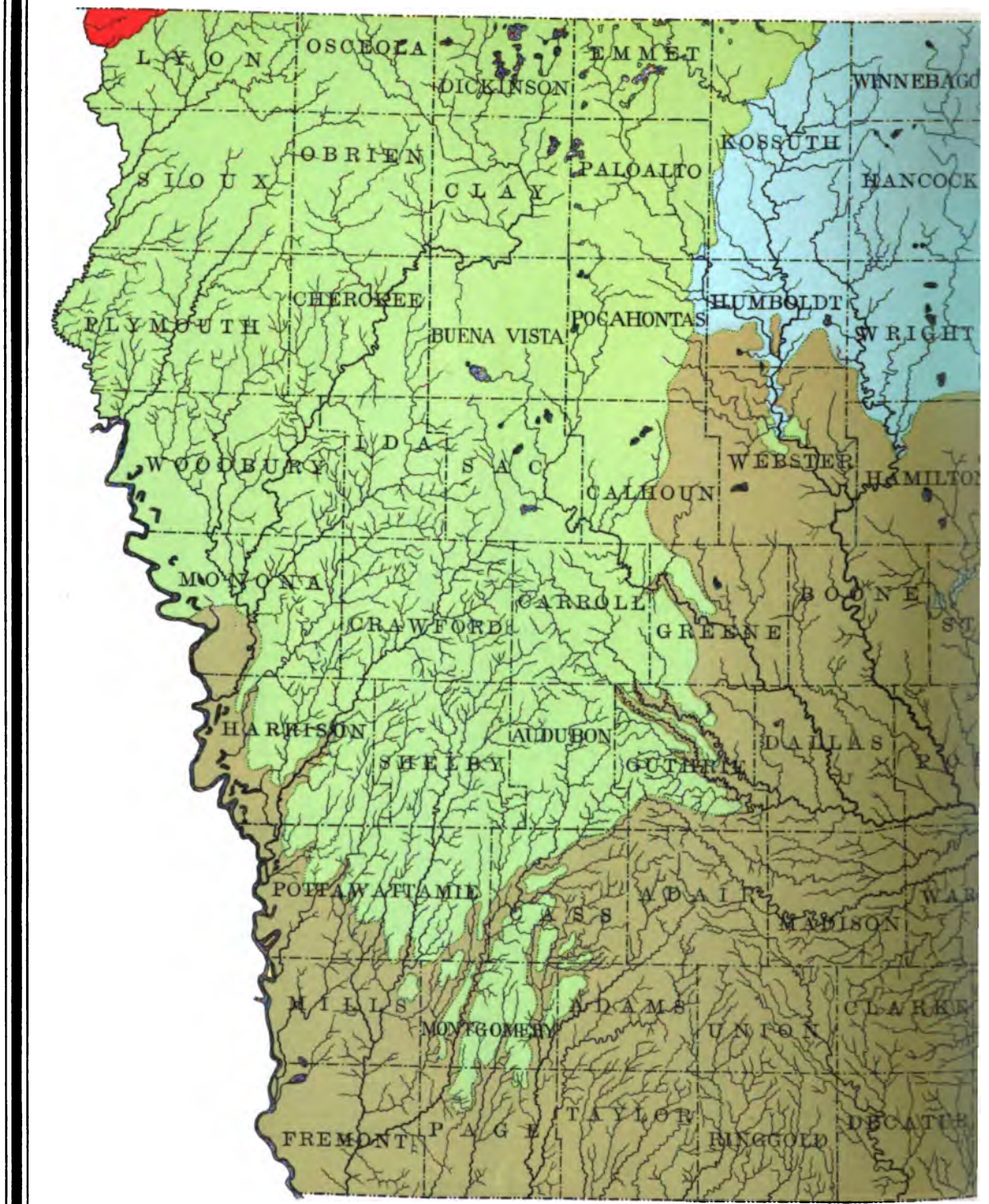
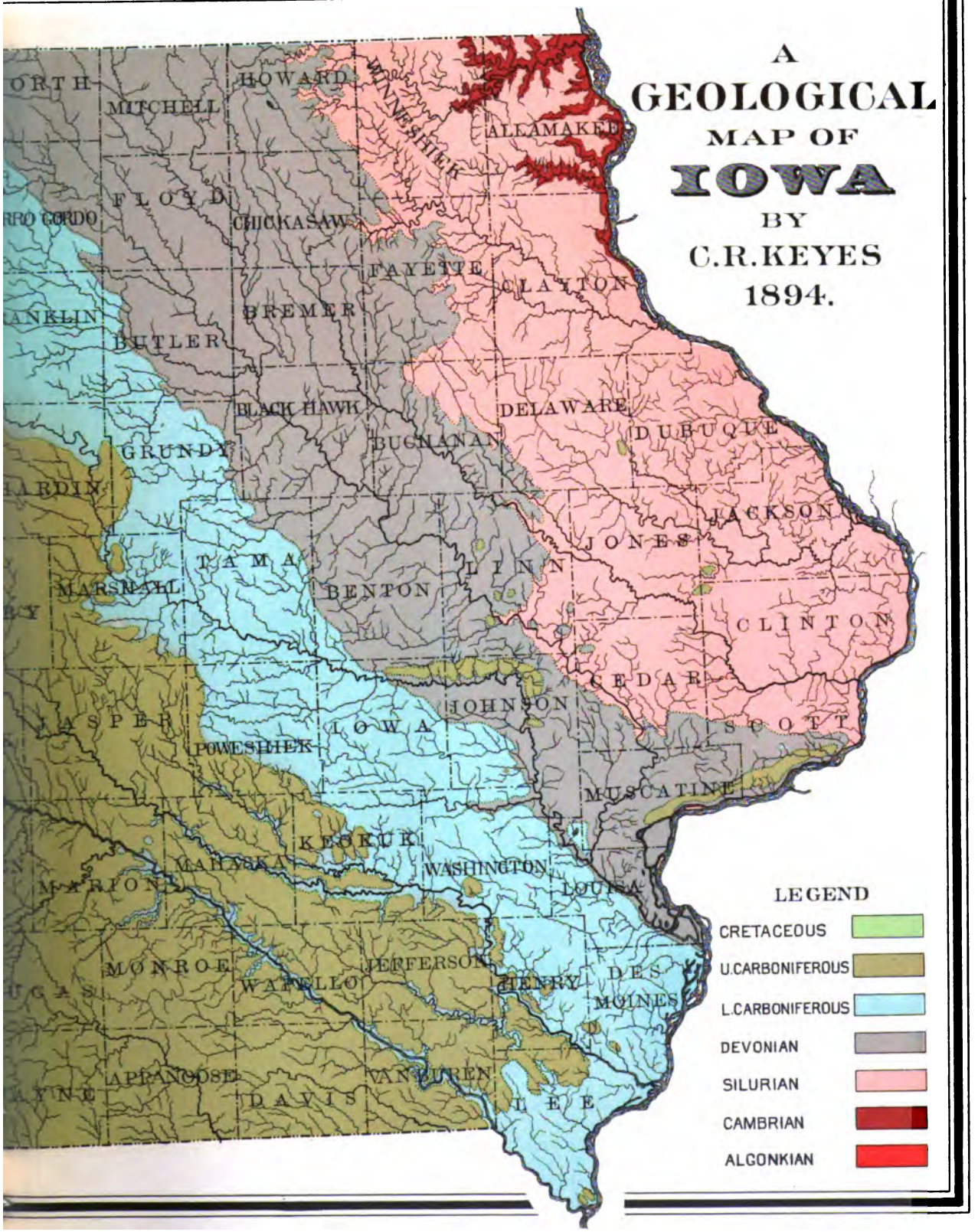


PHOTO LITH. BY A. HOEN & CO. BALTO. MD.

PLATE I.


A
GEOLOGICAL
MAP OF
IOWA
BY
C.R.KEYES
1894.
ORTH
MITCHELL
HOWARD
WINNESHIEK
ALLAMAKEE
FLOYD
RRO GORDO
CHICKASAW
FAYETTE
CLAYTON
ANKLIN
BREMER
BUTLER
BLACK HAWK
DELAWARE
DUBUQUE
GRUNDY
BUCHANAN
ARDIN
JACKSON
JONES
TAMA
LINN
MARSHALL
BENTON
CLINTON
CEDAR
JOHNSON
JASPER
IOWA
SCOTT
POWESHIEK
MUSCATINE
KEOKUK
MARION
MAHASKA
WASHINGTON
LOUISA
MONROE
JEFFERSON
HENRY
DES
MOINES
WAPELLO
APPANOOSE
VAN BUREN
DAVIS
LEE
LEGEND
CRETACEOUS
U.CARBONIFEROUS
L.CARBONIFEROUS
DEVONIAN
SILURIAN
CAMBRIAN
ALGONKIAN

ors and others interested in outside work often want a record of days when there was rain or high winds, when streams were frozen over or swollen with floods, etc. Farmers are interested in the state of the season, whether forward or backward, as regards temperature and rainfall. A double supply of blank forms is furnished observers in order that a copy of the weather record may be retained for their own use.

FEBRUARY WEATHER REPORT.

The month of February, 1894, was nearly 3 degrees, colder than the average of recent years. At the central station the minimum temperature was at or below zero on nine days during the month.

The average precipitation for the month, 0 89 inches, was half an inch below the normal amount. The principal storm periods of the month were 9th to 12th and the 20th. The southern and eastern portions of the State received the larger amount of moisture.

The following table gives, as a basis of comparison, the mean temperature and total precipitation for the month of February at the stations named for the years from 1872 to 1894, inclusive:

YEARS.	MEAN TEMPERATURE, DEGREES.						PRECIPITATION, INCHES.					
	Des Moines.	Davenport.	Dubuque.	Keokuk.	Omaha.	Sioux City.	Des Moines.	Davenport.	Dubuque.	Keokuk.	Omaha.	Sioux City.
1872	....	27	....	30	28	....	.....	0 10	....	0.39	0.43	....
1873	....	24	....	25	27	....	.....	0.77	.....	0.53	0.04	....
1874	....	26	23	29	23	....	.....	0.74	0.49	0.88	0.92	....
1875	....	10	6	18	13	....	.....	1.09	2.12	1.84	0.51	....
1876	....	30	28	35	30	....	.....	3.63	1.53	1.45	0.40	....
1877	....	36	35	38	37	....	.....	0.07	0.26	0 15	0.44	....
1878	....	37	36	39	37	....	.....	1.09	1.93	2 05	0 14	....
1879	25	25	22	29	27	....	1.90	1.09	1.00	0.53	0.93	....
1880	32	34	29	36	31	....	0.17	1.72	1.01	1.94	0.14	....
1881	20	20	20	25	18	....	2.68	4.14	3.70	2 58	3.09	....
1882	36	40	36	40	36	....	1.21	0.62	0.59	1.54	0.60	....
1883	19	24	18	25	22	....	2.51	4.42	2.60	6.13	1.09	....
1884	22	27	22	28	10	....	1 92	0 98	2 19	1.38	1.42	....
1885	15	17	13	17	17	....	0.42	1.20	0.72	1.14	0.47	....
1886	25	23	22	27	24	....	0.52	1.52	1.36	1.40	0.36	....
1887	19	24	20	30	18	....	1.65	4.87	3.56	5.19	1.00	....
1888	20	21	18	26	26	....	1.51	1.17	1.31	2.17	0.74	....
1889	20	17	17	25	23	....	0.27	1.44	1.34	0.90	0.23	....
1890	22	31	29	33	25	23	1.18	1.10	1.25	1.09	0.54	0.40
1891	33	26	23	29	20	13	1.13	0 89	0.98	1.32	1.02	1.26
1892	29	31	29	34	30	25	1.35	1.38	1.02	1.61	0.54	0.97
1893	17	17	15	21	20	15	1.28	1.69	1.30	1.76	0.97	0.77
1894	20	22	20	26	22	19	1.39	1.48	1.22	1.46	1.30	0.19
Means	23	25	23	28	26	19	1.32	1.67	1.59	1.83	0.80	0.72

SUMMARY OF WEATHER CONDITIONS.

BAROMETER. — Mean pressure for the month, 30.20 inches. Highest observed, 30.89 inches, at Davenport and Clarinda, on the 23d. Lowest observed, 29.20 inches, at Keokuk, on the 9th. Range for the month, 1.69 inches.

TEMPERATURE. — Monthly mean, as determined from seventy voluntary observers' reports, 19.7°. Highest monthly mean, 27.8°, at Ft. Madison. Lowest monthly mean, 13.4°, at Sibley. The highest temperature reported was 60°, at Glenwood, on the 7th. The lowest temperature reported was 19° below zero, at Atlantic, on the 21st. Average daily maximum, 30°. Average daily minimum, 9.2°. Average monthly maximum, 50.3°. Average monthly minimum, 9 1° below zero. Greatest monthly range, 72°, at Atlantic. Least monthly range, 44°, at Mt. Pleasant. Average range for the State, 59.5°. Total range for the State during the month, 79°.

PRECIPITATION. — Average for the State, as determined from seventy-four voluntary observers' reports, 0.89 inches. The greatest amount reported, 2.41 inches, at Seymour. The least amount reported, a trace, at Rock Rapids and Sibley. The average number of days on which .01 inch or more rain or melted snow fell, 3; cloudy days, 4; partly cloudy days, 8; clear days, 16.

Solar Halos—Alta, 6th, 10th, 13th, 14th and 20th; Amana, 8th, 11th, 19th, 20th, 21st and 26th; Hopeville, 8th, 10th and 21st; Monticello, 8th and 20th; Des Moines, 6th and 8th.

Lunar Halos—Alta, 14th, 15th, 16th and 19th; Amana, 10th and 16th; Cresco, 15th; Carroll 14th and 15th; Glenwood 14th and 18th; Hopeville, 18th; Monticello, 15th and 19th; Des Moines, 15th, 17th and 19th.

Auroras—A beautiful auroral display was reported very generally throughout the state on the evenings of the 22d and 23d.

Snow—Total snowfall during the month ranged from a trace at Sibley and Rock Rapids to 19 inches at Mechanicsville.

ATMOSPHERIC PRESSURE.

STATIONS.	Mean reduced barometer.	EXTREMES.			
		Highest barometer	Date.	Lowest barometer	Date.
Cedar Rapids	30.22	30.84	23	29.37	9
Clarinda	30.22	30.89	23	29.43	9
Cresco	.....	30.89	23	29.49	9
Davenport	30.17	30.86	24	29.33	9
Des Moines	30.19	30.85	23	29.42	9
Dubuque	30.16	30.88	24	29.38	9
Keokuk	30.17	30.83	24	29.20	9
Omaha (Neb)	30.23	30.85	23	29.50	9
Sioux City	30.20	30.84	23	29.56	9
Means	30.20	30.89	23	29.20	9

WIND MOVEMENT.

STATIONS.	Miles.	Maximum velocity.	Direction.	Date.
Davenport	6,749	36	SW	10
Des Moines	5,655	32	SW	17
Dubuque	4,033	25	NW	10
Keokuk	6,012	37	NW	19
La Crosse (Wis)	5,351	26	W	22
Omaha (Neb)	5,266	22	SE	16
Sioux City	7,646	44	NW	9

OBSERVERS' NOTES.

Clinton.—DR. LUKE ROBERTS. A clear sky and zero temperature to the atmosphere, with a moderate west wind, marked the meteorological conditions prevailing at the incoming of February, 1894. The fair sleighing which had prevailed since January 23, was played out on the 5th.

At 7 P. M. on the 3d rain commenced and continued up to midnight of the 9th, snow and rain alternating and forming slush, which was not enjoyed by pedestrians. The total precipitation of this storm was .91 in.

The next storm was composed of snow, and prevailed from 9 P. M. of the 11th to 8 P. M. of the 12th, with a total precipitation to the depth of seven inches, which was badly drifted by the high wind prevailing from the northeast, which attained a velocity of twenty-six miles an hour. It will be remembered that this storm, though comparatively light in this locality, was wide-spread, covering nearly the whole country, and with devastating power in many places. Its center seemed to pass along or near the Ohio valley, and the great velocity of the wind, which was the interesting feature of the storm, extended hundreds of miles on either side, causing intense discomfort, notably in the cities of Kansas City, St. Louis, Chicago, and on the lakes. The precipitation south of the central belt was rain, and north, snow, all of which will prove beneficial rather than injurious to agricultural interests. The number of storm days during the month was six, and the total precipitation 1.91 inches, including snow melted; depth of snowfall nine inches.

The temperature of the air was at or below zero seven times, the minimum being 10 degrees below zero, occurring on the 21st, and the maximum 47 degrees above zero, occurring on the 27th. The first decade showed a mean temperature of 24.1 degrees, the second decade 19.1 degrees and the third decade or last eight days 15.5 degrees. The mean temperature for the month was 20.7 degrees, being 1.5 below normal. The cold spell was from the 19th to the 25th, inclusive; also the 1st and 4th were cold. The 20th was the coldest day, the mean temperature of which was only one-half degree above zero. The extreme range of temperature was 57 degrees. Six Februaries in the last sixteen years were colder; that of 1885 especially so, the mean temperature being only 8.3 degrees above. The warmest for the same period was in 1882, reaching a mean of 33 3 degrees.

An interesting auroral display occurred on the evening of the 22d between 9 and 10 o'clock. On the northern horizon rested a dark segment of a circle, rising about five degrees, bounded by a luminous straw-colored arc about one degree in width. To the northeast a flame in apearance like unto fire in the distance loomed up several degrees, but not strongly marked with red. To the northwest a similar illumination appeared, only much more interesting from its intense vermillion hue and flaming structure. On the following evening another electrical phenomenon appeared, but of less interest.

The movement of wind was 4,960 miles, and the prevailing direction was from the northwest. The maximum velocity was 26 miles an hour, occurring on the 12th. The number of clear days was 14, the number of cloudy days, 5, and partly cloudy days, 9. The number of clear days was greater, and the number of cloudy days less than any February for the last 16 years.

SEASON COMPARISON FOR DECEMBER, JANUARY AND FEBRUARY.

YEARS.	NO. STORM DAYS.			Depth of snow in inches.	Total precipitation — snow melted.	Temper'ture in degrees	Month having greatest precipitation.
	Rain.	Snow.	Total.				
1879-80	14	7	21	2	5.32	29.2	January.
1880-81	7	22	29	31	7.61	15.1	February.
1881-82	17	11	28	9	4.02	29.5	December
1882-83	9	23	32	31	8.03	15.0	February.
1883-84	9	19	28	33	4.48	18.6	February.
1884-85	10	25	35	45	7.70	12.2	December
1885-86	12	26	38	47	8.79	19.5	December
1886-87	12	20	32	28	7.66	16.8	February.
1887-88	20	16	36	34	6.87	17.0	December
1888-89	10	12	22	21	6.47	24.2	December
1889-90	18	8	26	12	5.67	31.0	January.
1890-91	10	7	17	10	6.28	26.3	January.
1891-92	9	9	18	17	5.76	26.2	December
1892-93	8	17	25	37	7.00	14.5	December
1893-94	10	10	20	9	5.22	22.6	January.
Summaries	175	232	405	366	96.88	317.7	
Means	11.6	15.5	27.1	24.4	6.45	21.2	

The winter just closed was 1.4 degrees warmer than a mean of the last fifteen years; yet this did not prevent the formation of ice in thickness and solidity for commercial purposes, and a bountiful supply was secured for the coming season's needs. The month closed with slight traces of snow, a cloudy sky and temperature about freezing.

Normal precipitation, 1.92 inches. Greatest snowfall, 14.8 inches in 1874; normal, 8.81 inches.

Greenfield.—J. G. CULVER. At 8.44 P. M. on the 22d commenced a beautiful auroral display. First a flat arch extending across the northern heavens, very dark from the horizon to the middle of the arch; then shading from purple to bluish green in center, then again back to faint purple. At 9.14 streams of great brilliancy appeared at intervals, extending as rays from the upper surface to a great height. At 9.23 the arch became much wider, and a secondary arch of red light appeared, with very rapid movements and changes. The dark segment below the arch changed to a gray color, and then assumed the form of a shirred sash curtain. As the moon arose several large bodies of much brighter light appeared in the northeast, extending upwards as faint streams. At 9.44 great bodies of red color extended through the arch from the horizon, alternately fading, reappearing and spreading in form of streamers. At 10 o'clock the moon was so bright the display became fainter and gradually disappeared, leaving only a faint diffused light in the north.

Concord.—J. M. ELDER. The finest auroral display ever seen at this place was observed on the night of February 23, at about 9 o'clock. The arch extended from northeast to northwest and in the center fully 40 degrees in height. Brilliant flashes of colored light kept constantly moving from east to west. At the same time, and independent of the aurora, a beautiful column of highly colored lights extended from the eastern horizon to the zenith. The colored lights were in constant motion, rendering distant objects visible to an unusual degree.

Monticello.—H. D. SMITH. The snow on the 15th was off the open ground, but if the banks had been averaged there would probably have been 1 inch, and at the end of the month 2 inches. Snow covered the ground most of the month. The number of days during the winter when the thermometer touched zero or below was 24. Last year, 37.

The maximum temperature for February since 1854, was 60° in 1877; minimum for the same period, 32° below zero. The highest mean for February was 34.6°, in 1878; lowest mean, 7.5° in 1875; normal, 21.42°. Highest precipitation, 4.22 inches in 1857; lowest, 0.32 in 1877.

Amana.—CONRAD SCHADT. Brilliant auroras on the evenings of the 22d and 23rd and morning of 25th. At first there appeared a narrow arch of white light of about ten degrees altitude with darkness below. The arch widened and rose toward the zenith; beams, streamers and patches of light appeared, disappeared and changed places. Later the arch, beams and streamers began to change to a fiery red which commenced in the east near the risen moon, and soon extended to the west, the stars being plainly visible through it. In about two hours, at 10:00 P. M., the sublime spectacle had almost vanished. On the evening of the 23d the grand display repeated itself with an additional feature, which may be likened to the distant lightning along the horizon so often seen in summer evenings; or like gigantic waves of light, following each other in quick succession from near the horizon toward the zenith.

BELATED REPORTS.

Reports received too late to publish in the January review:

CLINTON, January, 1894.—Mean temperature, 23.4°; maximum temperature, 62° on the 17th; minimum temperature, 28° below zero on the 25th. Total precipitation, 2.02 inches. Prevailing wind, northwest. Rain or snow fell on 6 days. Total snowfall during the month, 9 inches.

APRIL'S PAST WEATHER RECORD.

DAVENPORT—22 YEARS' RECORD.

Temperature—Mean or normal temperature, 49°. The warmest April was that of 1878, with an average of 55°. The coldest April was that of 1874, with an average of 41°. The highest temperature during any April was 86° on the 7th, 1893. The lowest temperature during any April was 14° on the 2d, 1886. Average date on which last "killing" frost occurred (in spring), April 25th.

Precipitation—Average for the month, 2.72 inches. Average number of days with .01 of an inch or more, 11. The greatest monthly precipitation was 5.41 inches in 1892. The least monthly precipitation was 0.77 inch in 1884. The greatest amount of precipitation recorded in any 24 consecutive hours was 3.32 inches on the 11th, 12th, 1876. The greatest amount of snowfall recorded in 24 consecutive hours (record extending to winter of 1884-5, only), was 1.4 inches on the 21st, 1893.

Clouds and Weather—Average number of clear days, 8; average number of partly cloudy days, 13; average number of cloudy days, 9.

Wind—The prevailing winds have been from the northwest. The highest velocity of the wind during any April was 60 miles on the 1st, 1892.

DES MOINES—15 YEARS' RECORD.

Temperature—Mean or normal, 50°. The warmest April was that of 1886, with an average of 53°. The coldest April was that of 1881, with an average of 43°. The highest temperature during any April was 89° on the 13th, 1883. The lowest temperature during any April was 11° on the 1st and 13th, 1881.

Precipitation—Average for the month, 2.82 inches. Average number of days with .01 of an inch or more, 11. The greatest monthly precipitation was 4.32 inches, in 1886. The least monthly precipitation was 0.78 inch, in 1890. The greatest amount of precipitation recorded in any 24 consecutive hours was 1.91 inches, on April 30, 1893. The greatest amount of snowfall recorded in 24 consecutive hours (record extending to winter of 1884-5 only), was 8.0 inches, on April 20, 1893.

Clouds and Weather—Average number of clear days, 9; average number of partly cloudy days, 10; average number of cloudy days, 11.

Wind—The prevailing winds have been from the north. The highest velocity of the wind during any April was 64 miles per hour, on the 1st, 1892.

DUBUQUE—20 YEARS' RECORD.

Temperature.—Mean or normal, 49°. The warmest April was that of 1878, with an average of 54°. The coldest April was that of 1874, with an average of 41°. The highest temperature during any April was 84° on the 23d, 1879. The lowest temperature during any April was 14°, on the 2d, 1886. Average date on which last "killing" frost occurred (in spring), April 28th.

Precipitation.—Average for the month, 2.91 inches. Average number of days with .01 of an inch or more, 11. The greatest monthly precipitation was 4.47 inches in 1882. The least monthly precipitation was 1.30 inches in 1881. The greatest amount of precipitation recorded in any twenty-four consecutive hours was 2.54 inches on April 18, 1882. The greatest amount of snowfall recorded in twenty-four consecutive hours (record extending to winter of 1884-5 only), was 5.0 inches on April 13, 1892.

Clouds and Weather.—Average number of clear days, 7. Average number of partly cloudy days, 12. Average number of cloudy days, 11.

Wind.—The prevailing winds have been from the northwest. The highest velocity of the wind during any April was thirty-six miles per hour on the 12th, 1893.

KEOKUK—22 YEARS' RECORD.

Temperature—Mean or normal, 52°. The warmest April was that of 1878, with an average of 57°. The coldest April was that of 1874, with an average of 44°. The highest temperature during any April was 85° on the 7th, 1893. The lowest temperature during any April

was 20° on the 5th, 1881. Average date on which last "killing" frost occurred (in spring), April 9th.

Precipitation—Average for the month, 29.6 inches. Average number of days with .01 of an inch or more, 9. The greatest monthly precipitation was 6.15 inches in 1892. The least monthly precipitation was 0.89 inch in 1875. The greatest amount of precipitation recorded in any 24 consecutive hours was 2.64 inches on April 3d to 4th, 1892. The greatest amount of snowfall recorded in 24 consecutive hours (record extending to winter of 1884-5, only), was 2.3 inches on April 3, 1886.

Clouds and Weather—Average number of clear days, 7. Average number of partly cloudy days, 13. Average number of cloudy days, 10.

Wind—The prevailing winds have been from the southeast. The highest velocity of the wind during any April was 48 miles per hour from the southeast on the 13th, 1874.

COLDEST DAYS AT HOPKINTON.

Theodore Marks, the veteran weather observer at Hopkinton, Iowa, furnishes for publication the following table, giving date and degree of temperature of twenty-nine of the coldest days from 1852 to 1886:

DATE.	Sunrise.	2 P. M.	Sunset.
January 19, 1852	-26	-15	-10
February 8, 1853	-20	-4	-8
January 8, 1856	-24	-17	-21
January 18, 1857	-32	1	-10
December 9, 1858	-23	8	4
December 31, 1859	-21	-8	-10
January 1, 1860	-28	-4	-8
January 13, 1862	-26	-2	-10
February 14, 1862	-26	-3	-9
January 1, 1864	-28	-18	-23
January 2, 1864	-25	-12	-15
February 17, 1864	-20	-2	-8
February 15, 1866	-24	-10	-15
January 17, 1867	-24	-2	-4
December 14, 1872	-28	-4	-5
January 28, 1873	-23	-8	-14
January 9, 1875	-20	-6	-6
December 9, 1876	-20	-4	-2
January 2, 1879	-25	-15	-8
January 22, 1883	-26	-10	-12
January 4, 1884	-22	-20	-22
January 5, 1884	-32	-16	-15
December 18, 1884	-20	-22	-16
January 21, 1885	-20	-12	-15
February 10, 1885	-25	-15	-18
January 10, 1886	-26	-18	-20
January 11, 1886	-20	-3	-6
January 19, 1886	-24	-7	-10

METEOROLOGICAL DATA FOR FEBRUARY, 1894.

STATIONS.	TEMPERATURE OF THE AIR (IN DEGREES FAHRENHEIT).								PRECIPITATION IN INCHES.			Prevailing direction of wind.	No. of cloudless days.	No. of partly cloudy days.	No. of cloudy days.	No. of rainy days. (.01 inch or more).
	Monthly mean.	EXTREMES. Mean maximum.	Mean minimum.	Maximum.	Date.	Minimum.	Date.	Monthly range.	Monthly.	Total snowfall.	Depth of unmelted snow at end of month.					
Algona	16.2	....	....	44	27	-11	21	55	0.15	1.5	.....	SW	13	12	3	2
Alta	16.2	26.0	6.4	45	27	-16	21	61	0.30	3.0	.....	NW	17	8	3	5
Ames	16.8	28.5	5.2	50	27	-16	24	66	1.00	7.4	T	NW	17	9	4	4
Ames	....	....	....	....	....	....	....	....	0.53	5.5	.....	....	....	....	....	....
Amana	19.3	28.9	9.8	49	7	10	21	59	1.56	8.5	.....	NWSW	15	8	5	3
Atlantic	19.0	32.0	6.0	53	7	-19	21	72	1.15	11.5	.....	NW	15	9	4	4
Audubon	17.8	28.2	7.5	49	27	-14	21-24	63	0.85	8.5	.....	NW	8	9	11	2
Belle Plaine	19.4	29.3	9.5	51	27	-12	21	63	0.85	7.0	T	NW	11	10	7	3
Bonaparte	23.3	34.3	12.4	56	7	-1	24	57	0.40	....	.....	.....	....	....	....	....
Carroll	16.6	27.9	5.2	52	28	-14	21	66	1.00	10.0	.....	.....	17	8	3	3
Cedar Falls	18.9	30.0	7.8	53	27	-8	24	61	0.50	5.0	.....	NW	22	2	4	2
Cedar Rapids	20.9	28.9	13.0	50	7	-6	21	56	1.58	12.1	T	W	21	4	3	5
Charles City	15.9	25.2	6.5	55	27	-12	4-21	69	1.10	6.0	—	NW	....	....	....	4
Clarinda	21.3	31.5	11.0	51	7-28	-4	15	55	1.40	12.2	T	NW	19	5	9	3
Clinton	20.8	31.5	10.1	47	27	-10	21	57	1.91	9.0	T	NW	14	9	5	6
College Springs	22.3	33.9	10.7	56	7	-5	15	62	1.17	11.5	1.0	W	13	13	2	2
Corning	22.0	32.6	11.4	53	7	-7	24	60	1.72	14.0	T	NW	17	5	6	3
Cresco	15.4	25.5	5.5	46	27	-13	4	59	0.47	4.0	.....	SW	18	6	4	3
Davenport	22.0	29.9	14.3	50	7-27	-6	21	56	1.48	....	....	SW	11	10	7	6
Decorah	16.8	27.8	5.7	48	7	-14	4	62	0.35	5.5	.....	....	16	6	6	3
Delaware	15.8	....	....	52	....	-11	21	63	0.57	6.0	1.0	NW	16	9	3	4
Des Moines	20.6	30.2	10.8	54	27	-8	21	62	1.39	13.0	T	SW	16	9	3	5
Dubuque	20.0	28.8	11.2	49	7	-8	21	57	1.22	11.5	.....	NW	14	6	8	5
Elkader	18.2	31.1	5.5	52	27	-13	4	65	0.63	7.0	.....	W	19	6	3	4
Fairfield	22.8	31.5	14.2	54	7	0	21	54	1.88	15.5	.....	NW	....	....	....	7
Ft. Madison	27.8	....	....	52	7-26	-5	13	57	0.52	10.5	.....	SW	8	10	10	2
Galva	16.1	25.7	6.5	44	26	-15	21	59	0.06	....	.....	NW	11	14	3	2
Glenwood	23.4	36.6	10.3	60	7	-5	21	65	1.03	11.0	.....	S	15	9	4	2
Grand Meadow	19.1	....	....	47	27	-8	21	55	0.58	5.5	.....	NW	11	12	5	3
Greenfield	19.8	30.9	8.7	50	7-27	-12	21	62	1.03	9.7	.....	S	19	5	4	3
Grinnell	21.6	30.7	12.5	50	27	-8	21	58	0.45	4.5	..	W	15	10	3	3
Grundy Center	17.1	28.6	5.6	51	27	-12	21	63	0.49	2.8	..	NW	19	5	4	3
Hampton	16.8	27.1	6.5	45	27	-13	21	58	0.86	7.0	...	NW	16	12	0	3
Hawkeye	....	....	....	....	....	....	....	....	1.08	14.0	.....	....	....	....	....	3
Hopeville	20.5	30.5	10.6	53	7	-5	21	58	1.23	12.0	T	NW	8	18	2	3
Hopkinton	22.6	....	....	48	7	-7	21	55	0.60	6.0	.....	NW	10	15	3	3
Humboldt	....	....	....	....	....	....	....	....	0.40	4.0	.....	NW	18	7	3	3
Independence	18.2	28.5	7.9	49	27	-13	21	62	0.90	9.0	T	SWNW	19	4	5	3
Indianola	22.6	34.7	10.5	53	9	-9	21	62	0.77	....	.....	NW	....	....	....	....
Iowa City	22.5	34.7	10.3	54	7-28	-10	21	64	1.64	15.8	T	NW	13	11	4	5
Iowa Falls	15.8	27.2	4.5	46	27	-17	21	63	0.20	6.0	.....	NW	22	1	5	2
Keokuk	26.0	33.7	17.8	58	7	12	21	56	1.46	9.3	.....	NW	14	6	8	2
Keosauqua	25.5	35.4	15.5	58	7	12	21-24	56	1.47	12.0	.....	....	....	....	....	....
Knoxville	20.1	28.9	11.4	53	7	-7	21	60	1.20	13.0	.....	W	17	6	5	3
Larrabee	15.9	27.1	4.7	44	26	-13	21	57	0.26	2.7	.....	....	12	11	5	2
Logan	20.2	32.0	8.5	50	26	-15	23	65	0.70	7.0	.....	S	12	9	7	3
Le Claire	....	....	....	....	....	....	....	....	1.47	....	.....	....	....	....	....	....
Maxon	20.4	....	....	56	7	-5	20-21	61	1.28	8.8	.....	....	7	17	4	4
Mechanicsville	18.4	27.6	9.2	47	7	-9	21	56	1.47	19.5	5.0	NW	16	6	6	3
Milton	....	....	....	....	....	....	....	....	....	....	.....	SW	18	6	4	5
Monticello	17.4	26.5	8.2	45	7	-10	21	55	0.81	6.7	2.0	....	....	....	....	....
Mt. Pleasant	25.3	....	....	49	7	5	24	44	0.50	....	.....	SW	19	1	8	3
Mt. Vernon	19.4	....	....	44	6-27	-10	21	54	....	....	.....	....	....	....	....	....
Newton	19.2	30.2	8.3	51	27	-11	21	62	0.56	7.0	.....	S	21	3	4	3
Omaha (Neb.)	22.0	30.7	12.4	51	7	-4	19	55	1.30	....	.....	NW	12	11	5	4
Osage	14.0	....	....	....	....	10	21	....	0.50	3.2	.....	S	9	13	6	2
Oskaloosa	22.8	32.7	11.4	55	7	-6	21	61	1.12	9.0	.....	NW	19	3	6	4
Ottumwa	24.7	33.1	13.9	59	7	-1	21	60	0.80	10.0	.....	W	18	5	5	5
Panama	17.8	27.9	7.8	46	7-8	-12	21	58	0.31	3.1	.....	SW	17	8	5	3
Richland	20.1	....	....	54	7	-7	24	61	1.47	16.0	.....	....	12	13	3	5
Rockwell City	....	....	....	....	....	....	....	....	0.32	3.5	.....	....	21	3	4	2
Rock Rapids	14.5	25.7	3.2	46	26	-14	19	60	T	T	.....	S	12	16	0	....
Sac City	17.0	24.5	9.6	45	27	-12	21	57	0.55	5.5	.....	SW	11	14	3	3
Seymour	24.6	30.0	13.2	57	8	0	15-25	57	2.41	14.2	.....	NW	19	2	7	4
Sibley	13.4	24.1	2.6	42	26	-13	1-15-19	55	T	....	.....	NW	17	10	1	0
Sioux City	18.6	28.4	8.7	48	20	-10	19	58	0.19	....	.....	NW	15	9	4	1
Spirit Lake	15.0	25.2	2.8	45	7-8	-13	19	58	0.10	....	.....	NW	21	2	5	1
Tipton	21.2	31.5	10.9	49	6-7	9	21	52	1.86	12.0	.....	W	21	2	5	3
Toledo	20.5	....	....	50	27	-11	21	61	0.50	6.0	.....	NW	18	4	6	3
Villisca	21.2	31.6	10.8	54	7	-5	23	59	1.42	14.2	.....	NW	15	9	4	3
Vinton	19.7	....	....	51	7	-9	24	60	0.80	6.0	.....	NW	23	2	3	3
Washington	23.6	33.3	12.0	58	7	-5	21	63	1.25	14.0	.....	NE	....	....	....	4
Webster City	17.0	....	....	48	27	-12	21	60	0.75	3.6	.....	NW	19	2	7	3
West Bend	14.1	....	....	44	26	-12	21	56	0.60	8.0	.....	NW	20	6	2	4
Williams	16.3	....	....	46	27	-16	21	62	0.33	2.1	.....	W	14	11	3	3
Winterset	21.3	31.6	10.9	50	7-27	-9	21	59	1.30	13.0	.....	NW	13	9	6	3
Means	19.7	30.0	9.2	50.3	.....	-9.1	.....	59.5	0.89	8.4	.....	NW	15.6	7.2	4.5	3.3

DAILY AND MONTHLY MEAN TEMPERATURE FOR FEBRUARY, 1894.

STATIONS.	DATE.																												Monthly Mean.
	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	
Algona	6	23	10	14	25	30	29	31	27	4	23	12	10	7	12	28	21	14	0	-2	4	11	4	10	33	33	34	31	16.2
Alta	5	18	8	19	25	34	30	32	27	4	23	18	15	8	8	24	22	23	-2	9	-2	9	4	9	33	36	36	30	16.2
Ames	8	17	12	6	29	33	33	34	30	9	6	14	12	6	8	20	24	26	2	1	-1	8	5	12	18	39	40	34	16.8
Amana	11	22	14	10	26	37	36	34	33	17	11	20	14	14	12	18	34	24	8	2	1	11	8	14	28	40	40	35	19.3
Atlantic	12	24	16	18	24	36	36	34	26	12	4	14	12	9	11	25	32	30	6	-1	0	11	8	6	24	38	40	35	19.0
Audubon	9	22	16	18	26	32	34	34	25	9	4	14	12	10	8	23	30	26	4	0	-2	11	8	4	25	36	38	34	17.8
Belle Plaine	8	27	14	8	26	34	36	35	32	16	9	18	16	14	12	20	32	26	8	2	1	12	9	6	16	37	40	35	19.2
Bonaparte	17	30	25	16	32	39	44	36	32	24	15	18	18	18	12	32	34	27	12	10	10	16	12	12	25	41	44	34	23.3
Carroll	9	11	11	16	18	29	33	33	23	6	5	12	14	11	9	23	27	27	3	4	-2	10	1	5	22	31	32	39	16.6
Cedar Falls	10	20	18	10	26	33	34	34	32	12	6	16	14	14	12	18	34	22	4	4	3	12	9	8	18	39	42	38	18.9
Cedar Rapids	14	26	15	8	25	32	38	36	32	17	13	20	16	17	16	22	34	32	10	7	2	14	10	8	16	41	38	36	20.9
Charles City	3	22	10	4	22	29	28	28	23	12	4	16	15	15	8	20	22	24	-2	-1	-3	13	7	12	15	42	40	36	15.9
Clarinda	14	26	19	26	32	36	38	38	34	24	10	5	16	16	14	8	24	30	28	4	4	8	14	8	14	25	27	39	41	21.3
Clinton	7	24	17	10	26	37	35	34	32	18	20	19	19	22	13	25	35	30	12	0	2	14	6	10	16	38	37	33	20 8
College Springs	14	28	25	25	33	32	41	40	33	13	4	13	14	15	6	20	32	32	17	10	6	15	8	10	24	37	42	36	22.3
Corning	12	27	23	26	31	27	38	38	28	10	6	15	12	14	10	24	33	32	12	8	8	16	7	9	24	37	39	36	22.0
Cresco	6	16	6	4	21	28	30	32	27	6	3	14	16	12	8	16	24	22	0	-1	4	11	6	6	18	27	35	32	15.4
Davenport	13	28	16	11	29	40	42	38	34	20	16	21	14	17	15	20	37	28	12	4	2	14	10	11	18	30	43	34	22.0
Decorah	6	19	11	3	20	30	28	30	33	11	5	14	14	18	12	16	28	23	2	0	5	8	6	26	25	32	37	...	16.8
Delaware	2	21	8	4	22	30	32	31	31	12	8	16	12	13	8	19	32	22	4	-2	3	8	4	2	15	26	35	32	15.8
Des Moines	10	24	18	14	30	38	40	38	31	10	9	17	12	10	9	24	35	29	6	4	4	14	9	8	22	34	44	34	20.6
Dubuque	12	24	16	9	27	36	36	34	33	16	10	18	14	17	18	18	36	26	10	4	2	14	10	8	18	28	30	34	20.0
Elkader	8	18	14	7	25	29	32	32	32	13	9	18	15	13	12	16	30	25	7	2	4	14	10	7	22	26	40	32	18.2
Fairfield	16	30	13	16	32	38	46	38	28	17	14	20	19	15	12	24	26	20	12	10	8	15	11	...	...	34	42	41	22.8
Ft. Madison	22	26	23	21	33	42	45	40	36	24	22	21	17	23	17	28	41	35	17	13	15	21	17	26	36	42	40	38	27.8
Galva	6	14	15	21	24	25	30	27	26	8	2	...	12	7	9	...	25	26	0	-1	-2	10	11	9	22	32	36	25	16.1
Glenwood	23	30	20	25	35	40	44	41	27	9	4	15	20	19	12	32	32	29	3	5	8	16	14	10	28	38	42	36	22.4
Grand Meadow	9	25	6	10	28	38	33	36	32	10	10	18	14	15	12	26	30	26	2	0	5	13	4	7	22	31	40	33	19.1
Greenfield	9	26	16	16	28	36	38	36	28	11	4	15	16	12	8	24	30	30	8	2	1	12	5	10	24	34	40	35	19.8
Grinnell	10	23	19	11	26	36	39	36	38	21	8	16	15	16	12	24	35	29	16	6	2	14	11	10	20	32	41	38	21.6
Grundy Center	10	20	6	16	28	33	34	34	20	8	6	12	16	13	10	24	24	20	3	2	0	10	4	7	20	32	40	34	17.1
Hampton	8	20	9	8	26	33	32	32	28	10	4	14	14	12	8	20	24	23	0	-2	1	12	4	6	21	32	36	35	16.8
Hopeville	13	26	20	18	33	36	40	38	28	10	6	15	12	14	8	21	31	29	10	2	5	14	6	12	21	34	39	35	20.5
Hopkinton	11	25	15	12	26	37	38	36	34	18	11	19	17	19	15	22	36	26	11	6	11	15	10	14	18	30	42	36	21.8
Independence	8	18	14	6	24	30	34	34	32	12	8	16	16	14	14	17	33	24	4	1	0	12	10	5	16	28	39	38	18.2
Indianola	10	24	...	15	31	38	39	36	41	24	7	...	13	10	10	24	34	30	20	6	-2	22	10	10	22	36	42	39	22.6
Iowa City	20	24	17	12	28	38	40	37	36	24	14	21	16	15	14	18	36	27	24	7	2	10	12	8	16	29	42	44	22.5
Iowa Falls	7	18	10	6	24	32	32	31	26	12	2	12	15	11	7	20	24	24	0	-2	-2	9	2	4	18	29	36	34	15.8
Keokuk	19	32	22	18	34	44	50	38	34	21	19	24	15	16	14	26	40	34	14	9	10	18	14	14	22	37	46	36	26.0
Keosauqua	19	34	26	19	34	42	46	36	36	24	15	20	19	14	15	21	36	29	22	8	12	19	12	14	22	33	44	40	25.5
Knoxville	10	24	16	14	30	38	41	37	32	12	8	16	14	12	6	22	30	28	6	6	4	13	8	10	19	34	42	33	20.1
La Crosse (Wis.)	11	22	10	7	26	28	34	32	32	12	4	16	17	14	12	18	32	23	3	0	8	16	6	8	22	29	40	36	19.0
Larrabee	4	18	9	22	24	30	28	34	24	6	0	12	14	8	10	26	21	19	-2	-1	0	10	2	9	23	36	36	32	15.9
Logan	17	24	17	22	28	31	34	37	25	8	2	14	12	6	11	25	30	31	11	6	22	6	4	26	32	39	39	...	20.2
Maxon	12	28	13	16	32	36	40	39	30	11	9	15	10	10	9	32	32	28	5	-10	4	12	4	10	22	36	40	32	20.4
Mechanicsville	10	30	13	8	24	34	36	33	30	16	12	19	14	17	12	17	34	24	8	0	2	10	7	6	14	32	36	34	18.4
Monticello	6	21	11	6	22	32	35	34	32	12	12	18	14	18	7	23	30	26	6	0	-2	10	4	3	18	28	27	32	17.4
Mt. Pleasant	18	33	20	18	24	41	43	40	34	18	20	22	16	16	15	26	38	36	12	8	13	16	12	16	24	36	42	40	25.3
Mt. Vernon	9	26	10	11	29	38	37	36	32	12	14	18	15	16	9	24	31	28	5	0	-1	10	5	8	20	32	38	35	19.4
Newton	8	20	18	10	28	35	36	36	36	18	8	16	12	10	9	22	30	28	9	1	1	11	6	8	16	30	41	40	19 2
Omaha (Neb.)	15	28	18	26	35	38	38	41	25	9	4	12	10	11	10	26	31	28	3	3	6	14	10	13	28	38	42	36	22 0
Osage	4	18	1	4	18	26	28	26	32	7	4	16	16	14	6	21	27	12	-3	-2	-1	10	3	4	18	26	30	34	14.0
Oskaloosa	14	26	20	16	32	40	42	36	33	20	12	19	17	12	12	24	34	29	16	3	5	14	8	10	20	36	43	34	22.4
Ottumwa	18	32	15	21	37	43	40	38	31	18	16	19	17	14	12	34	34	32	...	5	10	18	11	15	24	38	44	34	24.7
Panama	11	22	18	24	28	32	33	38	28	9	2	11	10	8	9	23	22	26	4	0	0	9	4	7	24	33	36	33	17.8
Richland	12	28	10	16	30	37	36	36	30	16	12	18	10	13	8	25	30	30	7	4	3	14	4	10	22	32	36	35	20.1
Rock Rapids	17	20	12	18	21	24	25	29	22	1	4	8	11	10	8	14	20	10	4	-1	1	7	3	8	30	33	36	30	14.5
Sac City	5	19	10	20	26	31	31	29	28	5	4	10	15	7	6	28	28	26	2	3	0	12	4	14	22	30	38	34	17.0
Seymour	16	28	28	18	33	38	44	42	36	20	10	17	13	13	10	22	36	30	23	8	8	15	17	26	20	34	43	36	24.6
Sibley	0	14	9	18	19	24	22	29	24	5	-2	8	10	9	4	22	22	17	-4	-2	0	10	5	8	22	25	24	30	13.4
Sioux City	10	24	12	24	28	34	32	38	22	4	0	10	15	7	14	26	27	21	-3	0	4	12	8	12	26	38	38	35	18.6
Spirit Lake	1	18	10	9	20	25	26	30	25	9	4	9	10	6	14	32	20	22	-4	0	2	13	6	9	24	24	29	29	15.0
Tipton	12	26	19	14	28	38	39	36	32	22	12	14	14	18	15	20	32	32	21	2	14	10	8	14	17	30	40	35	21.2
Toledo	11	24	15	12	30	34	35	34	33	15	10	18	14	14	14	26	33	28	7	3	4	14	5	9	23	34	40	33	20.5
Villisca	30	36	47	32	31	30	36	36	21	10	8	10	10	8	25	28	20	5	4	4	4	11	4	15	22	34	38	35	21.2
Vinton	11	28	11	13	30	36	36	36	31	13	15	18	12	11	10	28	29	24	6	-1	8	13	7	8	19	32	38	33	19.7
Washington	16	30	17	16	34	41	44	38	32	18	14	20	14	14	15	22	34	28	12	2	6	14	12	10	21	33	44	34	21.3
Webster City	8	22	13	11	28	36	32	33	28	8	8	16	16	12	10	25	28	19	2	-2	-1	7	3	8	22	33	36	32	17 0
West Bend	9	22	4	11	24	29	26	29	24	1	3	11	10	6	8	26	18	13	-1	-4	3	10	2	0	22	32	34	...	14.1
Williams	8	22	8	12	26	32	29	32	28	6	7	10	17	9	8	28	24	16	0	-4	0	9	4	7	21	31	34	34	16.8
Winterset	12	24	18	15	31	36	36	35	35	11	5	21	15	18	9	24	35	30	5	5	9	10	9	10	21	35	40	35	21.6

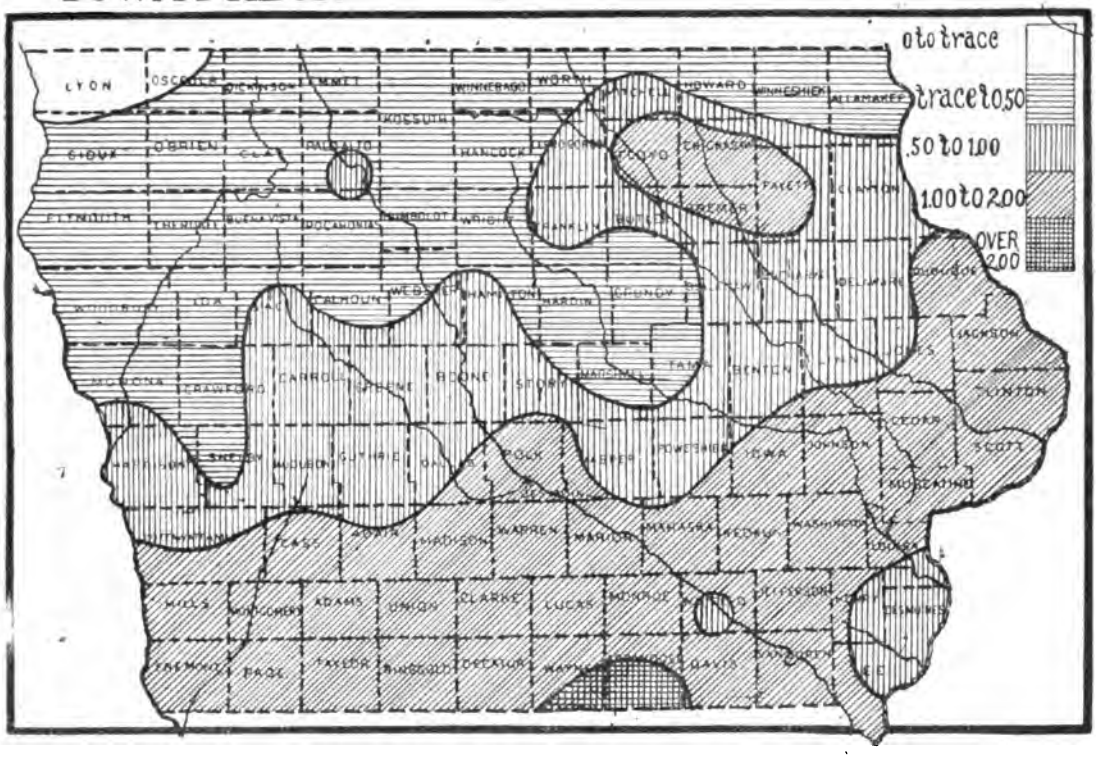
MAXIMUM AND MINIMUM TEMPERATURE FOR FEBRUARY, 1894.

STATIONS.	1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		Mon'y Mean.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Alta	18	-7	27	10	17	-1	27		10	38	12	40	29	38	32	42	32	42	26	15	9	-2	8	-4	34	1	35		5	16	0	24	-6	36	12	30	15	36	10	6	-10	4	-5	11	-16	20	-1	14	-6	20	-3	36	9	45	19	44	28	39	22	26	0.	6.4
Ames (Kent)	21	-4	32	2	17	8	21	-10	43	2	44	22	47	19	48	20	34	26	14	4	10	-2	21	8	35	0	21	-8	24	-6	35	5	38	3	40	27	43	10	10	-5	5	-3	12	-14	21	-4	16	-6	20	-16	37	-1	45	15	50	29	28.	5	5.2
Amana	23		37	8	19	10	23	-3	40	13	47	17	49	24	43	28	34	28	32	13	12	18	4	24	17	35	0	22	4	31	9	5	34	2	37	28	40	9	11	5	6	1	12	-10	24	-2	15	1	19	-9	32	-3	44	12	48	31	37	33	28	9	9.8
Atlantic	28	-5	34	14	25	10	30		5	46	3	50	33	53	18	40	19	35	17	19	4	6	3	33	4	33	-8	24	-6	35	-3	39	11	39	24	45	14	14	-1	13	-15	18	-19	27	-5	16	-11	28	-15	40	9	49	22	52	37	40	30	32.	0	6.0
Audubon	20	-2	32	11	32	9	27		9	41	12	42	32	46	32	45	24	34	16	16	8	7	1	33	4	34	1	21	0	19	-3	36	10	38	32	41	12	13	-5	6	-7	11	-14	24	-2	12	-6	32	-14	35	8	45	20	49	28	38	30	28.	2	7.5
Belle Plaine	20	-3	36	18	19	9	32	-5	39	12	45	24	49	24	45	25	35	28	34	11	16	8	12	15	26	5	35	2	21	4	37	3	40	25	42	10	12	2	8	-5	14	-12	25	0	14	0	20	-7	33	0	45	17	51	29	38	32	29.	3	9.5
Bonaparte	20	5	15	16	24	16	29	3	47	18	53	35	56	31	47	35	39	35	33	15	20	10	33	3	32	3	33	2	29	6	44	24	41	13	16	9	15	5	18	1	26	6	19	5	25	1	36	2	47	5	53	31	57	31	34.	3	12.4
Carroll	22	-4	17	5	18	4	32		0	32	5	43	15	46	20	46	20	34	10	12	0	12	-2	24	0	24	4	32	5	24	-6	36	10	34	20	42	12	12	-6	13		5	10	-14	26	0	10	-8	32	-12	37	8	42	20	44	21	52	26	27.	9	5.2
Cedar Falls	23		34		26	9	24	-4	43	8	45	21	47	20	46	21	35	28	15	8	13	-1	20	13	36	2	35	4	24		35	-1	39	29	42	3	10	-1	10	-3	16	-10	26	-2	18	0	20	-8	36	1	44	14	53	30	45	32	30.	0	7.8
Cedar Rapids	24	4	36	16	30	10	18	-1	38	12	45	19	50	25	44	27	35	29	33	13	20	6	24	15	32	9	34	10	30	11	33	12	42	27	37	26	12	8	9		5	10	6		25	4	16	5	18	-3	39	4	46	16	49	26	39	34	28.	9	13.0
Charles City	14	8	34	10	14	5	26	-12	40	4	40	18	40	16	38	19	34	32	16	7	12	-4	18	14	28	4	28	4	15	0	31	10	24	10	38	10	6	-11	4	-6	6	-12	29	6	16	-2	15	-10	25	5	30	15	53	25	40	32	25.	2	6.5
Clarinda	25	2	37	11	24	14	36		17	46	17	48	32	51	25	48	37	35	13	16	4	7	3	35	6	32	3	26	2	20	4	39	8	37	24	44	11	9	0	9		0	17	-1		6	15	1	27	-1	42	8	50	24	48	30	51	31	31.	5	11.0
Clinton	21		37	2	28	12	19	-2	30	9	46	12	45	24	44	24	37	33	33	15	25	8	25	15	28	4	29	14	24	8	34	3	40	28	41	12	34	8	13	-5	14	-10	24	-3	18	2	23	-6	30	-1	44	10	47	32	41	26	31.	5	10.1
College Springs	27	0	40	15	30	14	28		12	50	16	48	35	52	28	46	30	24		6	2	12	8	19	6	39	0	40	24	43	21	34	9	16	5	15	-3	25	5	17	-1	33	-2	42	-7	50	24	52	32	42	30	33.	9	10.7
Corning	25	0	38	10	31	15	35		17	45	17	47	37	53	24	49	37	38	15	17	3	10	3	35	5	37	-3	25	0	22	-4	38	10	40	26	43	21	24	0	14		3	19	-4		5	16	-2	25	-7	39	8	48	26	49	29	41	31	32.	5	11.4
Cresco	18	-5	31	1	14	-3	20	-13	36	6	39	18	42	17	42	22	32	27	11	1	12	-6	19	10	34	7	33	5	25	1	29	3	38	12	39	4	6	-5	4		6	16	-9	24		3	13	-1	18	-6	32	5	40	14	46	24	34	31	25.	5	5.3
Davenport	23	4	41	14	29	15	21	1	41	17	48	32	50	34	45	30	35	32	24	17	24	9	35	17	37	7	35	9	29	10	35	5	42	32	40	17	14	10	7	1	11	-6	25	2	15	4	20	2	32	4	45	15	50	35	37	32	29.	9	14.3
Decorah	18	-6	33	5	32	0	20	-14	37	4	40	19	43	14	41	16	36	30	17	5	14	-4	19	10	24	4	37	2	19	4	32	-1	38	18	40	6	8	-3	4	-5	18	-8	13	3	13	0	21	-9	35	6	42	9	48	29	42	32	27.	8	5.7
Des Moines	21		36	11	32	14	30	-3	43	17	45	31	52	37	47	38	35	37	13	7	14	4	33	11	29	4	32	3	20	2	29	8	42	28	43	15	12	0	9	0	15	-8	24	3	18	0	23	-6	37	6	48	21	54	33	38	30	30.	2	10.8
Dubuque	21		37	10	19	13	21	-3	40	14	45	26	49	31	43	34	34	32	18	13	18	1	32	14	32	6	34	10	33	13	35	3	43	28	42	10	12	7	8	0	13	-8	26	3	16	3	20	-5	33	3	41	10	47	32	38	39	28.	8	11 2
Elkader	24	-9	36	-1	21	6	27	-12	43	7	45	13	50	15	46	17	34	30	18	8	19	-1	31	14	38	2	38	-2	33	9	35	-4	41	20	43	7	13	1	10	-5	18	-11	27	0	20	1	24	-10	40	3	43	8	52	28	34	30	31.	1	5.5
Fairfield	25	6	43	18	24	5	28	1	43	26	50	35	54	34	46	31	35	32	23	11	16	12	33	18	24	14	42	8	19	5	36	12	41	11	35	5	14	9	14	5	16	0	24	6	17	5					50	17	53	32	48	34	31.	5	14.2
Galva	18	-7	18	10	28	2	27	15	38	10	30	20	40	20	42	12	35	17	17	6	5	2			25	-2	14	0	23	5			37	13	38	15	9	8	3	-5	11	-15	20	0	13	9	20	-2	35	10	44	20	43	38	35	15	25.	7	6.5
Glenwood	16	0	42	18	28	13	40	10	52	18	52	28	60	38	54	38	38	36	16	6	6	1	32	-2	34	6	34	4	28	-4	51	10	42	22	50	8	10	-4	10	0	22	-5	28	4	30	-2	35	-5	44	12	50	26	56	28	42	30	30.	6	10.3
Grundy Center	21	0	33	6	17	-4	25	4	42	15	41	22	46	23	44	25	34	34	6	16	-1	14	1	20	5	26	5	26	0	21		0	38	19	40	9	42	-2	9	-3	7	-12	13	-12	24	-3	14	-7	19	-5	35	5	45	20	51	29	36	31	28.	6	5.6
Grinnell	19		34	11	28	10	32	0	36	16	43	28	48	30	44	28	44	31	31	11	12	4	30	11	32	8	34	7	21	-3	37	11	40	30	41	17	31		15		12	-8	24	4	21	1	30	0	32	6	37	5	48	21	54	33	45	32	30.	7	12.5
Greenfield	22	-1	36	10	23	10	33	-2	41	15	46	26	50	26	47	26	36	37	19	3	8	1	24	6	29	3	34	1	21	-5	39	9	40	20	43	18	18	-3	11	-8	14	-12	24	0	15	-5	26	-5	33	9	47	22	50	29	40	30	30.	9	8.7
Hampton	19	-3	31	8	15	3	24	-7	40	12	42	24	42	21	44	20	34	33	11	-3	11	3	19	9	24	4	24	1	18	-3	35	5	34	15	41	5	-6	6	3	-6	15	-13	22	2	14	-5	20	-8	35	7	42	15	45	27	37	27	27.	1	6.5
Hopeville	26	0	37	16	27	12	33	3	46	20	48	35	53	38	48	39	37	38	18	3	9	2	21	9	33	12	33	5	18	-4	37	5	39	23	40	18	20	1	6	-3	15	-5	23	4	14	-1	25	-4	37	5	45	22	47	31	39	31	30.	5	10.6
Independence	20		33	3	23	9	21	-8	39	8	42	19	47	22	44	23	34	29	15	9	16	-1	20	13	24	7	24	4	21	-6	32	2	39	27	40	8	9	0	7	-5	13	-13	23	0	21	-1	24	-8	32	1	43	13	49	29	47	30	28.	5	7.9
Indianola	22	-3	34	15			31	-1	45	17	47	29	51	27	46	26	33	29	11	6			32	14	32	4	32	1	21	1	40	8	41	26	44	16	41	-1	12	-1	4	-9	13	2	21	-2	24	-5	38	5	46	17	51	32	48	30	34.	7	10.5
Iowa City	28		41	5	22	12	25	-1	44	11	51	24	54	35	48	36	41	32	34	14	20	7	26	16	30	1	28	2	21	8	38	3	42	30	44	10	40	7	11	3	15	-10	27	-6	32	3	21	-4	35	-3	47	11	52	32	54	34	34.	7	10.3
Iowa Falls	20	-6	31	-5	21	-1	23	-11	40	8	42	19	43	22	42	22	32	29	8	3	9	-5	16	7	37	3	35	-3	19	-5	34	7	35	13	41	8	9	-9	4	-9	14	-17	20	-2	12	-7	18	-10	33	3	41	16	46	25	40	27	27.	1	4.5
Keokuk	29		44	20	24	19	31		6	48	21	55	32	58	41	43	34	36	33	26	16	24	14	37	20	32	8	33	10	21		6	45	7	48	33	46	22	17	12	12		6	17		2	28	9	19	8	24		35	9	50	24	53	38	39	33	33.	7	17.8
Keosauqua	30		8	44	24	33	20	32	6	47	24	53	33	58	44	47	37	36	34	32	16	18	12	24	16	29	9	26	3	26		4	39	3	44	31	43	15	33	11	11		6	22		2	29	9	17	8	27		40	4	49	17	56	33	47	32	35.	4	15.5
Knoxville	29		0	35	12	30	13	28		1	42	18	48	29	53	29	47	27	33	30	15	8	12		4	33	10	24	5	21	3	13		1	38	6	31	28	41	14	12		1	11		0	14	-7		3	33	3	15	1	33	-4	35	3	46	22	52	32	35	31	28.	9	11.4
La Crosse (Wis.)	32		0	35	8	15	0	22	-8	40	13	43	13	48	19	46	19	34	30	16	9	12	-3	30	10	26	8	26	3	17	8	35	2	42	21	41	5	8	-2	6	-6	22	-6	24	8	12	1	22	-7	38	8	45	13	50	31	42	34	28.	9	8.5
Larrabee	18		10	27	10	20	-2	31	14	39	9	43	17	38	18	42	25	34	11	15	-2	4	-4	23	2	26	0	16	-1	27	-7	38	14	32	10	37	1	5	-10	5	-7	14	-13	21	0	14	-10	23	-5	38	8	44	8	43	28	40	25	27.	1	4.7
Logan	30		4	34	14	24	10	35	12	45	10	46	22	47	30	49	35	39	20	13	3	5	0	26	3	37	-3	15	-4	25	-3	40	10	38	23	43	19	29	-7	15	-3	35	10	25	-13	24	-15	40	12	45	19	50	23	49	29	39		32.	0	....
Mechanicsville	20		1	36	5	18	8	29	-5	38	9	45	23	47	25	41	35	38	20	12	20	4	33	15	24	5	24	10	18	7	31	3	39	28	38	9	11	5	7	-6	12	-9	24	-3	14	0	17	-5	28	-1	43	12	44	28	37	30	27.	6	9.2
Newton	19		3	34	6	28	9	24	-4	40	15	44	26	48	28	45	36	36	16	15	28	7	15	9	32	10	32	7	21	0	19	-1	38	6	40	20	43	12	19	-1	7	-5	13	-11	23	-1	16	-3	20	-5	34	-1	40	15	51	31	39	30	30.	2	8.3
Omaha (Neb.)	27		3	36	19	24	13	40	13	50	20	47	28	51	26	50	32	32	18	15	3	6	2	21	4	32	10	16	6	20	-1	39	12	40	22	41	14	10	-4	6		0	17	-4		6	17	3	25	-1	42	14	50	27	51	32	42	29	30.	7	12.4
Oskaloosa	25		2	38	15	29	12	31		0	45	19	51	30	55	29	46	25	38	28	28	11	17	8	32	16	28	6	24	1	20	3	40	7	41	25	43	15	28	5	9		3	16	-4		3	16	0	25	-5	40	1	50	21	53	33	37	32	32.	8	11.9
Ottumwa	28		5	43	17	32	11	32	4	49	10	54	33	59	32	48	39	41	28	36	13	19	8	33	9	35	10	33	4	32	4	42	8	45	30	46	12			8		2	16	-1		2	22	9	18	3	35	3	39	6	52	22	57	35	45	33	33.	1	13.9
Panama	23		1	30	14	28	9	32	15	42	11	42	23	46	21	46	29	36	15	16	2	5	0	21	1	33	-3	13	4	32	-4	35	11	33	11	40	11	13	-5	4	-5	13	-12	19	-1	13	-6	22	-8	38	9	45	21	45	28	37	29	27.	9	7.8
Rock Rapids	26		8	38	11	30	-6	30	5	30	12	34	15	38	12	39	17	30	13	7	-5	15	-7	33	-7	35	-3	21	-1	33	-7	35	-7	30	10	14	7	7	-14	5	-7	13	-11	20	-6	17	-11	30	-3	36	13	46	20	38	33	40	20	25.	7	3.2
Sac City	16	-6	26	12	16	5	26	13	36	15	39	23	38	24	39	18	30	26	10	0	6	1	17	3	35	6	15	-1	16	-5	36	16	35	20	31	20	9	-5	8	-2	11	-12	15	6	10	-1	18	10	34	11	39	20	45	30	44	24	24.	5	9.6
Seymour	28		5	40	15	38	18	33	3	48	18	52	27	56	32	57	37	44	32	32	8	13	7	24	10	35	1	21	5	20	0	40	5	42	30	43	16	42	4	12	5	15	0	35	5	30	4	44	8	40	0	47	21	53	33	42	31	36.	0	13.2
Sibley	13	-13	21	8	12	-4	23	13	33	5	36	12	36	8	41	17	32	15	13	-3	2	-7	18	-1	33	-2	20	-2	24	13	32	12	32	13	30	4	5	-13	2	-6	12	-11	18	3	18	-8	20	-4	35	8	42	8	36	12	38	22	24.	1	2.6
Sioux City	24		3	32	15	32	3	35	16	44	13	42	25	45	20	47	30	31	14	10	-1	3	-2	21	-2	24	6	13	1	31	-2	38	13	36	18	38	4	4	10	5	-5	16	-9	21	4	16	-1	24	0	40	13	48	24	43	33	43	27	28.	4	8.7
Spirit Lake	12	-10	28	9	23	-4	24	-6	35	4	35	15	45	6	45	15	35	15	20	-2	14	-6	20	-2	33	-3	17	-5	30	-1	33	30	32	7	41	4	6	-13	6	-7	15	-12	32	4	19	-8	21	-3	42	7	35	12	44	14	40	18	27.	2	2.8
Tipton	25		0	40	12	28	10	24	5	41	16	49	27	49	29	42	29	35	30	32	12	19	4	21	7	24	5	28	7	21	9	35	4	41	24	41	32	37	5	9	-4	18	-9	19	-2	17	0	32	-5	34	0	45	14	45	43	39	31	31.	5	10.9
Villisca	30	10	47	25	54	40	41	-22	42	20	40	20	49	32	47	26	36	6	15	5	12	5	24	-2	33	-4	19	-3	38	12	38	18	39	1	10	0	11	-3	10	-3	11	-2	23	-1	12	-5	25	5	39	6	45	22	46	29	40	30	31.	6	10.8
Winterset	26	-1	35	13	23	14	32	-2	45	17	48	30	50	28	45	25	45	32	16	6	9	2	27	15	30	0	27	0	21	-3	40	8	40	30	44	17	12	-1	12	0	15	-9	25	2	19	0	25	-5	38	5	47	23	50	30	39	30	29.	6	10.9

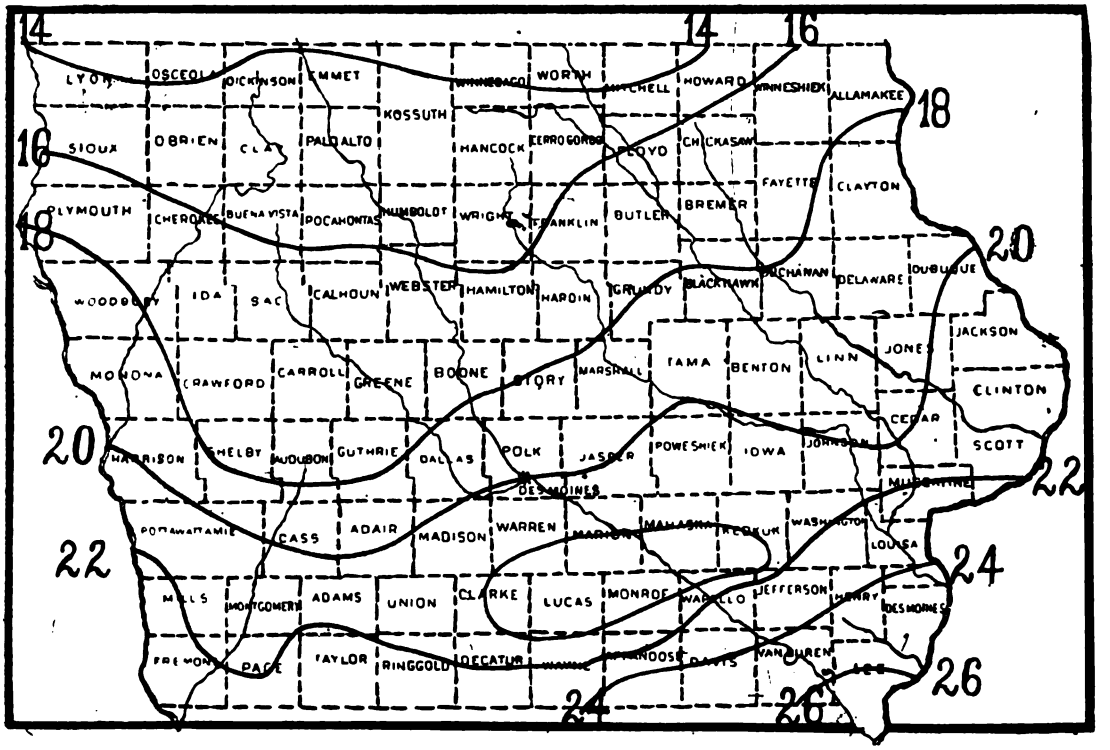
DAILY AND MONTHLY PRECIPITATION FOR FEBRUARY, 1894.

STATIONS.	DATE.																													Total.
	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th	27th.	28th.	
Algona	....	....	....	....	....	....	....	....	0.10	....	T	....	....	....	....	....	....	....	....	0.05	....	....	....	....	....	....	....	....	0.15
Alta	....	....	....	....	....	....	....	....	0.03	....	....	0.05	0.02	..	....	....	....	T	....	0.20	....	....	....	....	....	....	....	....	0.30
Ames (W. H. Helleman)	....	....	....	....	....	....	....	....	0.13	....	....	0.34	....	....	....	....	....	....	....	0.06	....	....	....	....	....	....	....	....	0.53
Ames (I. A. C)	....	....	....	....	....	....	....	....	0.17	....	....	0.49	....	0.03	....	....	....	....	....	0.31	....	....	....	....	....	....	....	....	1.00
Amana	....	....	....	....	....	....	....	....	....	0.49	....	0.94	....	..	....	....	....	....	....	0.13	....	....	....	....	....	....	....	....	1.56
Atlantic	....	....	....	....	....	....	....	....	0.40	....	....	0.50	....	....	....	....	....	....	....	0.25	....	....	....	....	....	....	....	....	1.15
Audubon	....	....	....	....	....	....	....	....	....	....	....	0.50	....	....	....	....	....	....	....	0.35	....	....	....	....	....	....	....	....	0.85
Belle Plaine	....	....	....	....	....	....	....	....	0.15	....	....	0.50	....	....	....	....	....	....	....	0.20	....	T	....	....	....	....	....	....	0.85
Bonaparte	....	....	....	....	....	....	....	....	0.28	....	....	0.12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.40
Carroll	....	....	....	....	....	....	....	....	0.25	....	....	0.45	T	T	....	....	....	....	....	0.30	....	....	....	....	....	....	....	....	1.00
Cedar Falls	....	....	....	....	....	....	....	....	0.10	....	....	0.40	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.50
Cedar Rapids	....	....	....	....	....	....	....	....	0.32	0.15	....	0.46	0.30	....	....	....	....	T	....	....	0.35	....	....	....	....	....	....	....	1.58
Charles City	....	....	....	....	....	....	....	....	0.30	....	....	0.20	....	....	....	....	....	0.50	....	0.10	....	....	....	....	....	....	....	....	1.10
Clarinda	....	....	....	....	....	....	....	....	1.00	....	0.38	....	....	....	....	....	....	....	....	0.02	....	....	....	....	....	....	....	....	1.40
Clinton	....	....	....	....	....	....	....	....	0.91	....	....	0.79	....	....	....	....	0.04	....	....	0.17	....	....	....	....	....	....	....	....	1.91
College Springs	....	....	....	....	....	....	....	....	0.47	....	0.70	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1.17
Corning	....	....	....	....	....	....	....	....	1.20	....	0.52	....	....	....	....	....	....	....	....	T	....	....	....	....	....	....	....	....	1.72
Cresco	....	....	....	....	....	....	....	....	0.28	....	....	0.15	....	T	....	....	....	....	....	0.04	....	....	....	....	....	....	....	....	0.47
Davenport	....	....	....	....	....	....	....	T	0.58	0.03	T	0.70	T	0.01	T	....	0.02	....	....	0.14	....	....	....	....	....	....	....	....	1.48
Decorah	....	....	....	....	....	....	....	....	0 21	....	....	0.13	....	....	....	....	0.01	....	....	T	....	....	....	....	....	....	....	....	0.35
Delaware	....	....	....	....	....	....	....	....	0 26	....	....	0 11	....	....	....	....	0.06	....	....	0.15	....	....	....	....	....	....	....	....	0.57
Des Moines	....	....	....	....	....	....	....	....	0.37	T	0.07	0 70	T	0.01	T	....	....	....	T	0.24	....	T	....	....	....	....	....	....	1.39
Dubuque	....	....	....	....	....	....	....	0.29	....	....	....	0.86	T	0 01	....	....	0.01	....	....	0.05	....	....	....	....	....	....	....	....	1.22
Elkader	....	....	....	....	....	....	....	....	0.21	0.03	....	0.31	....	....	....	....	....	....	....	0.08	....	....	....	....	....	....	....	....	0.63
Fairfield	....	....	....	....	....	....	....	0.01	0.42	....	0.01	1.35	....	....	0.04	....	....	....	0.02	0.03	....	....	....	....	....	....	....	....	1 88
Ft. Madison	....	....	....	....	....	....	....	T	T	....	....	0 52	....	....	....	....	T	....	T	T	....	....	....	....	....	....	....	....	0.52
Galva	....	....	....	....	....	....	....	....	....	....	....	0.01	....	....	....	....	....	....	....	0.05	....	....	....	....	....	....	....	....	0.06
Glenwood	....	....	....	....	....	....	....	....	1.00	....	0.03	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1.03
Grand Meadow	....	....	....	....	....	....	....	....	0 29	....	....	0.19	....	....	....	....	T	....	....	0.10	....	....	....	....	....	....	....	....	0.58
Greenfield	....	....	....	....	....	T	....	....	0.33	....	....	0.44	T	T	....	....	....	....	0.26	....	....	....	....	....	....	....	....	....	1.03
Grinnell	....	....	....	....	....	....	....	....	0 20	....	T	0.15	T	T	....	....	....	....	....	0.10	....	....	....	....	....	....	....	....	0 45
Grundy Center	....	....	....	....	....	....	....	....	0.12	....	....	0.25	....	....	....	....	....	....	....	0.12	....	....	....	....	....	....	....	....	0.49
Hampton	....	....	....	....	....	....	....	....	0.23	....	....	0.43	T	T	....	....	....	....	....	0.20	....	....	....	....	....	....	....	....	0.86
Hawkeye	....	....	....	....	....	....	....	....	0.45	....	....	0.60	....	....	T	....	....	....	....	0.03	....	....	....	....	....	....	....	....	1.08
Hopeville	....	....	....	....	....	....	....	T	1.00	....	0.11	0.12	T	T	....	....	....	....	....	T	....	....	....	....	....	....	....	....	1.23
Hopkinton	....	....	....	....	....	....	....	....	0.20	....	....	0 20	....	T	....	....	....	....	....	0.20	....	....	....	....	....	....	....	....	0.60
Humboldt	....	....	....	....	....	....	....	....	0.20	....	....	....	....	....	....	....	....	....	....	0.20	....	....	....	....	....	....	....	....	0 40
Independence	....	....	....	....	....	....	....	....	0 30	....	....	0.35	....	....	....	....	....	....	....	0.25	....	T	....	....	....	....	....	....	0.90
Indianola	....	....	....	....	....	....	....	....	0.21	....	....	....	T	T	....	....	....	....	0.56	T	....	....	....	....	....	....	....	....	0.77
Iowa City	....	....	....	....	....	....	....	....	0.08	0.18	....	1.10	....	....	0.05	....	T	....	....	0.23	....	....	....	....	....	....	....	....	1.64
Iowa Falls	....	....	....	....	....	....	....	....	....	....	....	0.15	....	....	....	....	....	....	....	0.05	....	....	....	....	....	....	....	....	0.20
Keokuk	....	....	....	....	....	....	....	0.12	0.45	0.02	0.05	0.70	....	0.05	0.01	....	0.04	....	T	0.02	....	....	....	....	....	....	....	....	1.46
Keosauqua	....	....	....	....	....	....	....	....	0.27	....	0.10	1.10	....	....	T	....	T	....	....	....	....	....	....	....	....	....	....	....	1.47
Knoxville	....	....	....	....	....	....	....	....	0 10	....	....	1.00	....	....	....	....	....	....	....	0.10	....	....	....	....	....	....	....	....	1.20
La Crosse (Wis)	....	....	....	....	....	....	....	....	0.81	0.05	T	0.02	....	0.01	T	0	T	....	T	T	....	T	....	....	....	....	....	....	0.89
Larrabee	....	....	....	....	....	....	....	....	T	....	....	0.06	T	T	....	....	....	T	....	0.20	....	....	....	....	....	....	....	....	0.26
Logan	....	....	....	....	....	....	....	....	0.10	....	0.30	....	....	....	....	....	....	....	....	0.30	....	....	....	....	....	....	....	....	0.70
Le Claire	....	....	....	....	....	....	....	....	0.61	0.11	....	0.36	0.28	....	....	....	0.11	....	....	....	....	....	....	....	....	....	....	....	1.47
Maxon	....	....	....	....	....	....	....	....	0.41	0.05	0.02	0.80	....	T	....	....	....	....	....	T	....	....	....	....	....	....	....	....	1.28
Mechanicsville	....	....	....	....	....	....	....	....	0.50	....	....	0.70	....	....	....	....	....	....	....	0.27	....	....	....	....	....	....	....	....	1.47
Monticello	....	....	....	....	....	....	....	....	0.31	....	....	0.18	....	....	....	....	0.02	....	....	0.30	....	....	....	....	....	....	....	....	0.81
Mt. Pleasant	....	....	....	....	....	....	....	....	0.28	0.07	....	0.15	....	....	....	....	T	....	....	....	....	....	....	....	....	....	....	....	0.50
Newton	....	....	....	....	....	....	....	....	0.07	....	....	0.35	....	....	....	....	....	....	0.14	....	....	....	....	....	....	....	....	....	0.56
Omaha (Neb)	....	....	....	....	....	....	....	....	1.11	....	0.07	0.05	T	....	....	....	....	....	....	0.07	....	....	....	....	....	....	....	....	1.30
Osage	....	....	....	....	....	....	....	....	0.30	....	....	0.20	....	T	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.50
Oskaloosa	....	....	....	....	....	....	....	0.25	0.25	....	....	0.50	....	....	....	....	....	....	....	0.12	....	....	....	....	....	....	....	....	1.12
Ottumwa	....	....	....	....	....	....	....	....	0.30	....	....	0 40	....	....	0.05	....	....	....	....	0.05	....	....	....	....	....	....	....	....	0.80
Panama	....	....	....	....	....	....	....	....	0.08	....	....	0.13	....	....	....	....	....	....	0.10	....	....	....	....	....	....	....	....	....	0.31
Richland	....	....	....	....	....	....	....	0.22	0.27	....	....	0.91	....	T	0.01	....	T	....	....	0.06	....	T	....	....	....	....	....	....	1.47
Rockwell City	....	....	....	....	....	....	....	....	....	0.08	....	....	....	....	....	....	....	....	....	0.14	....	....	....	....	....	....	....	....	0.22
Rock Rapids	....	....	....	....	....	....	....	....	T	....	....	T	....	....	....	....	....	....	T	....	....	....	....	....	....	....	....	....	T
Sac City	....	....	....	....	....	....	....	....	0.05	....	0.20	....	....	....	....	....	....	....	....	0.30	....	....	....	....	....	....	....	....	0.55
Seymour	....	....	....	....	....	....	....	....	0.47	0.28	0.36	1.30	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2.41
Sibley	....	....	....	....	....	....	....	....	T	....	....	T	T	T	....	....	T	T	T	....	....	....	....	....	....	....	....	....	T
Sioux City	....	....	....	....	....	....	....	....	T	T	0.01	0.04	0.01	....	....	....	....	T	T	0.13	....	....	....	....	....	....	....	....	0.19
Spirit Lake	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.10	....	....	....	....	....	....	....	....	....	....	0.10
Tipton	....	....	....	....	....	....	....	....	0.55	....	....	1.25	....	....	T	....	T	....	....	0.06	....	....	....	....	....	....	....	....	1.86
Toledo	....	....	....	....	....	....	....	0.12	....	....	....	0.40	....	....	....	....	....	....	....	0.20	....	....	....	....	....	....	....	....	0.72
Villisca	....	....	....	....	....	....	....	....	0.60	....	0.80	....	....	....	....	....	....	....	0.02	....	....	....	....	....	....	....	....	....	1.42
Vinton	....	....	....	....	....	....	....	....	0.20	....	....	0.30	0.30	T	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.80
Washington	....	....	....	....	....	....	....	T	0.42	....	....	0.78	....	0.05	....	....	....	....	....	T	....	....	....	....	....	....	....	....	1.25
Webster City	....	....	....	....	....	....	....	....	0 12	....	....	0.38	....	T	....	....	T	....	....	0.25	....	....	....	....	....	....	....	....	0.75
West Bend	....	....	T	T	....	....	....	....	0.10	....	T	0.20	T	0.10	....	....	T	T	....	0.20	....	....	....	....	....	....	....	....	0.60
Williams	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....

IOWA PRECIPITATION CHART FEBY. 1894.



MEAN TEMPERATURE FEBY. 1894.



METEOROLOGICAL STATIONS AND OBSERVERS.

From the following, weekly and monthly reports of Meteorological data are received by the Iowa Weather and Crop Service.

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Ames	E. C. Dickinson.
Ames	Fred L. Kent.
Atlantic	J. W. Love.
Audubon	J. F. Hooker.
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Blakeville	James Rodgers.
Blockton	C. W. Thompson.
Bonaparte	Hon. B. R. Vale.
Carroll	Moses Simon.
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Clinton	Luke Roberts.
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Eldora	Prof. C. F. Woodward.
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Fairfield	J. Fred Clarke, M. D.
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Ft. Madison	Miss L. A. McCready.
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Galva	W. A. Crowley.
Glenwood	Seth Dean.
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Hampton	E. C. Grenelle.
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Osage	G. D. Pattingill
Oskaloosa	Jos. Boyd.
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Panama	Wm. J. Wicks.
Postville	F. L. Williams.
Richland	Wm. A. Shaffer.
Rock Rapids	W. C. Wyckoff.
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Sidney	G V. Swearingen.
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Toledo	Chas. Mason
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Winterset	Will McKnight
West Bend	Phil. Dorweiler
Williams	M. L. Fuller

*U. S. Weather Bureau.

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Ames	Henry C. Wallace
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Van Horn	Spencer Smith
Wapello	O. P. Smith
Waukee	John Wragg
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Willow Creek	W. S. Nicholson
Winterset	H A. Kinsman
Wall Lake	F. E. Wilcox
Walnut	F. L. Martin
What Cheer	O. D. Lawrence

Met. 217

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UNITED STATES DEPARTMENT OF AGRICULTURE
WEATHER BUREAU.

MONTHLY REVIEW

OF THE

Iowa Weather and Crop Service.

VOL. V. —MARCH, 1894.—NO. 3.

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LOCAL FORECAST OFFICIAL,
U. S. WEATHER BUREAU, ASS'T DIRECTOR.

DES MOINES:
G. H. RAGSDALE, STATE PRINTER.
1894.

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U. S. Department of Agriculture—Weather Bureau.

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MONTHLY REVIEW

OF THE

IOWA WEATHER AND CROP SERVICE.

VOL. V.] MARCH, 1894. [No. 3.

EDITORIAL NOTES.

The Alabama Weather Record and Agriculturist, is the title of a new monthly magazine, published at Montgomery, Alabama, under the auspices of the State Weather Service. The name of F. P. Chaffee, local forecast official for Alabama, appears as editor and publisher; Wm. M. Dudley, observer Weather Bureau, serves as assistant editor, and Frank E. Purse is business manager. It is an interesting publication, highly creditable to the enterprising gentlemen in charge.

***

A London cablegram, dated March 20th, stated that in several parts of Germany heavy snowfall interrupted railway traffic. In some places railway trains were imbedded. In Silesia the snow fell sixty hours. Our planetary weather seers, who predicted very stormy weather in March, can cite this dispatch in making up their hind-cast.

***

Prof. Selim Lemstrom has recently published a pamphlet for the benefit of the people of Finland, on "Night frosts and the means of preventing their ravages." His study of the nature and causes of frosts occurring during the crop growing season led to the conclusion that they could be prevented either by the production of artificial clouds, or by creating currents in the air, or by both means combined. To accomplish this frost torches were devised, constructed of well-dried peaty mud, molded in form of tubes, which were lighted when needed by means of kindling cylinders inserted in the tubes. These torches were so placed as to produce air currents or clouds of smoke over the fields to be protected. From extensive observations on the subject the author lays down the following rules regarding the forecasting of frosts: The danger of frost is great if a calm comes on after clear days having a low temperature. The danger is greater in proportion to the dryness of the air, and greatest if the dew-point is below zero. The probability of frosts can be judged from the color of the sky after sunset; the more the blue tone predominates the greater is the danger; if the color tends more toward gray the danger is less. If even a very slight motion in the air continues to within an hour or an hour and a half before sunrise no damage by frost need be feared.

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If our planetary weather sharps should display as much astuteness in making their forecasts as they do in figuring out verifications, they would become famous among the seers and prophets of the world.

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The Canadians deal with a food counterfeiter just as they do with a money counterfeiter, and they are successful in their treatment of both. A bogus coin dealer assails the credit of all the people, and a bogus butter dealer assails the credit of the farmers who produce and everybody who consumes, and all for his own profit.—*Prof. James Wilson.*

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A few years ago a number of scientists of New England made a calculation as to the amount of water given to the atmosphere by the "Washington Elm," Cambridge, Mass. They calculated that the leaves of that tree would cover over 200,000 square feet of surface, and that they gave out every fair day during the growing season 15,500 pounds or 7¾ tons of moisture.

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A comparison of the temperature in Berlin with that just outside, great pains having been taken to insure reliable results, has been made by Prof. G. Helliman. The influence of a great many houses is considerable, the yearly mean temperature proving to be nearly 1 degree higher than in the suburbs, the difference being greatest in the season from March to August, and least in winter, although in severe cold the difference has been as great as 14 degrees. The greatest variation occurs in the evening, amounting in summer to 2 degrees or more, and even exceeding 5 degrees on calm evenings.

Replying to numerous inquiries, Secretary Morton expressed the opinion that no valuable results had been obtained from the rain-making experiments carried on by the government.

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Observer A. W. Lewis, of Murray, Iowa, sent to this office a chip from a log about two feet in diameter, found in a well at a depth of twenty-seven feet below the surface. The well was dug on a high ridge, and following is the record of formations passed through: Soil, three feet; heavy yellow clay, twelve feet; fine dry sand, ten feet; dirt that looks like soil, two feet. In this layer of soil the tree was found.

METEORIC DUST.

Under date of March 31st, Mr. Conrad Sehadt of Amana, Iowa, writes: "March 14th a meteor passed by from southeast to northwest at 11:15 A. M. A trail of light was seen and a report like thunder heard. March 27th another meteor passed over in the same direction (southeast to northwest) at 8:15 P. M. A sudden flash of light was seen in the lighted room and a few minutes later the windows rattled and many persons heard a report like an explosion. At Marengo, 11 miles west of here, the light was nearly as bright as daylight. It was also seen and heard at Cedar Rapids, and was probably noticed much further away."

Concerning this phenomenon, Mr. Gustav Holm of Marengo, writes as follows: "About 8:20 last night (March 27) a brilliant meteor passed over our town toward the northwest. Two distinct detonations were heard by persons happening to be out of doors. Snow commenced to fall here about 7:45 P. M. and continued nearly all night. The next morning we were surprised to find that we had a layer of clean snow and then a layer of sand. A farmer told me that in his timber, located about eight miles northwest of this place, the sediment appeared black like ashes. Could this have any connection with the meteor? With two witnesses I melted enough of this snow to fill a quart bottle and it had the color of dark soda water."

In a subsequent letter, responding to a request, Mr. Holm sent a sample of the dried sediment referred to above. It is a fine, powdery substance, of a brown, ashy hue, having every appearance of the product of combustion of meteoric rock. Placed under a microscope the minute articles appeared to be silica and iron.

From other points near the line of the meteor's flight we have reports of dark colored snow observed on the morning of March 28th. When the snow melted the following day, the sediment remaining on boards and walks appeared like fine, dark sand.

Prof. A. L. Arner, of the State University, Iowa City, writes: "During the night of March 27 occurred a light fall of snow. A shower of dust fell followed by a second fall of snow."

H. D. Smith of Monticello, reports the meteor at 8:15 P. M. of March 27. The weather was cloudy, but the meteor made it light as day.

Observer Vandyke of Belle Plaine, sends the following extract from a local paper: "The flash and rumble heard Tuesday night, March 27, supposed to be lightning and thunder, was a brilliant meteor passing over. Snow was falling at the time, mixed with a fine dust, supposed to have been shaken off by this visitor from the heavens, and many samples of the same were gathered and placed under microscopic scrutiny."

The reasonable inference from all the facts relating to this phenomenon is that the discoloration of the snow which fell on the night of March 27th, was caused by meteoric dust—the product of the combustion and explosion of the celestial visitant which passed through the air during the snow storm.

DEPRESSING EFFECTS OF LOW PRESSURE.

A medical man points out in *Science* that the influence of the weather on mental effort should prove a study of no little importance. In his own experience he has been amazed at the faulty deductions and misconceptions which were made in damp, foggy weather, or on days in which the air was charged with electricity, what seemed clear then being found later to be filled with error. An actuary in a large insurance company is obliged to stop work at such times, because his errors make the work useless. In a large factory from 10 to 20 per cent less work is brought out on damp days and days of threatening storm, and this factor is taken into account by the superintendent in taking orders to be delivered at a certain time. Many persons in the fire insurance business have a theory that in states of depressing atmosphere greater carelessness exists and more fires follow. Locomotive engineers have some curious theories of trouble, accidents and increased dangers at such times, attributing it to the machinery.

Experience and observation bear witness that there is a measure of truth in the above paragraph. All animate nature is sensitive to changes of atmospheric pressure. Even the strongest and most healthy man is conscious of the depressing effects of a "low," while invalids and nervous people are more powerfully affected thereby. The human organism is possessed of barometric qualities, more or less perfectly adjusted to receive impressions of external changes. Persons afflicted with chronic rheumatism, neuralgia or gout are unpleasantly affected by the diminishing pressure, increasing humidity and heat which usually precede a storm. The lower animals and some species of plants exhibit similar sensitiveness to these atmospheric changes. In fact nature hangs out her signals, giving warning of coming elementary disturbance, before the flags of the weather service are displayed.

Some years ago the writer visited an air-bath institute, established for the relief of asthmatic and consumptive patients, and accepted an invitation to take a "treatment." The patients were placed in an airtight iron cylinder, into which sterilized air was pumped until they were subjected to a pressure equal to three times the weight of the normal atmosphere. The sensations caused by the increasing pressure were of a striking character. The ears

tingled, crackled and ached. The lungs were oppressed, and the patients were forced to take in deep inhalations to restore the equilibrium. After a time there came a sense of exhileration, and the weaker patients seemed possessed of unusual strength of body and mind. The air seemed charged with high tonic properties, and the effect was especially marked upon the sensitive and nervous subjects. When the reverse process began, the pressure being diminished, the unpleasant sensations were again experienced, and these continued until the normal pressure was reached. Then came a feeling of lassitude, drowsiness and indisposition to put forth effort of any kind. This experience illustrates some of the effects produced by the alternations of high and low pressure; though in the natural order the changes are more gradual and less extreme. All people feel better and can accomplish more work during the prevalence of a "high" than when the barometer is depressed.

It would be an interesting and profitable study to note the effects of low pressure upon the vital statistics of a large community. There may be no facts to prove it, but it seems probable that the death rate is greater during the prevalence of low pressure. This is a question worthy of inquiry and experiment by physicians and superintendents of hospitals. If this hypothesis is established, it would indicate the need of extra care and watchfulness during the periods of greater danger.

INFLUENCE OF FORESTS ON CLIMATE AND AGRICULTURE.

BY C. P. CRONK.

When trees enough to make a forest are massed together they may exert a potent influence upon the climate and agriculture of a locality. The velocity of the wind along the surface of the earth is decreased, less air passes over the ground and, consequently, less moisture is taken up. The earth does not rapidly dry out, bake and crack open, thus becoming unfit for cultivation, and plants with weak stalks, like wheat and corn, are protected from gales that otherwise would overthrow them.

It is possible that protection from the tornado may be obtained by tree-planting. Certainly the presence of trees on the great plains of the west would tend to reduce the energy of the cyclonic disturbances which are, themselves, the tornado producers. The cyclonic storms are originated by the overheating of a limited portion of the earth's surface. The air above expands and rises, and the surrounding air rushes in to take its place. The rotation of the earth sets up the necessary gyratory movement and gives direction to the disturbance; precipitation occurs, latent heat is liberated, and the storm is formed. Many of our great storms form on the great plateau east of the Rocky Mountains, and it has been advanced that the planting of trees in this region, to prevent the overheating of the earth's surface, would diminish the energy of these storms and thus lessen the frequency of tornadoes. The surface of the ground would be cooler in summer, a smaller amount of heat would be furnished, and heat is essential to the production and life of these cyclonic areas A forest is, also, a shield which offers a considerable degree of resistance to the tornado. Buildings in the open are more often destroyed than those in the lee of woods.

In winter, in those portions of the country exposed to chilling winds, trees are invaluable as wind-breaks. In the west and northwest the timber belts that have been grown by the settlers are particularly valuable in the protection they afford to flocks and herds; and if a dense tree belt could be grown across northern Texas the terrors of the norther would be much lessened.

As the tree in the summer cools the surrounding atmosphere by the evaporation from its many surfaces, conversely, in winter it warms the surrounding air by radiating heat. It not only absorbs heat during the day, to be radiated back again into the atmosphere at night; it also makes heat—a certain amount of warmth is generated in it, as it is developed in the bodies of animals, by the physiological changes going on within. This heat also is radiated, as heat is radiated from animals, and the temperature of the surrounding air is raised. This warming influence may be proven by the thermometer; and in winter, when snow lies upon the ground, it is demonstrated by the bare spaces about the roots of trees. Trees, then, warm the winters and cool the summers, and bring nearer to each other the maximum temperature of the day and the minimum temperature of the night.

Forests protect from lightning. The trees of the forest, being very good conductors of electricity, relieve the electric tension of the earth and clouds, thus giving protection to the surrounding country. The lightning strikes the isolated tree, but rarely one in the forest. For the same reason lightning rarely does damage in a city. The great mass of material of which a city is built acts as a mediator between earth and sky and the electricity is usually conducted quietly away. It is the solitary barn or dwelling in the country that is struck.

It is the ground itself, however, that is most perfectly protected by the forest of a country. The roots and rootlets of the trees bind together the particles of soil so that it is not readily washed away. As a matter of course, hills shorn of their forests suffer most, their soil being washed down into the river or the valley below. This is the reason why valleys are generally fertile and why so many hills are barren. But if the wooded hills and mountains are preserved as such, the rain or snow which falls upon them does not rush as floods into the valleys, overflowing rivers and creeks and carrying destruction to crops, animals, and perhaps to the inhabitants themselves. The roots of the trees and the accumulated mold have rendered the soil porous and capable of holding a great amount of moisture. The rain and the snow are conserved and gradually given to the streams (which have their headwaters there) and soil below. Before a country has been denuded of forests, its streams do not vary greatly in size from season to season. Rain or drought influences them but little; but after the trees have been taken away the rivers are roaring torrents during rains and mere threads during drought.

In the State of Iowa it has been conclusively proven, by comparison of the records of the State Weather Service, that the annual rainfall is more evenly distributed throughout the year in the more heavily wooded portions of the State. Data recorded in other portions of the country give the same evidence. This evenness of rainfall distribution is of unusual value to agriculturists, and the reason is obvious. The annual rainfall for a place varies but little from year to year. If a great deal of it falls at one time, or during one storm, crops are injured by the complete saturation of the ground or by the rush of waters. A drought succeeds the flood, and that portion of the crop not destroyed by the water very likely succumbs to extreme heat and dryness; but if the supply of rainfall occurs in showers, the ground each time receives the proper amount for the sustenance of the plants.

Trees and all plants favor the formation of dew. Dew is especially beneficial to vegetation when the annual rainfall is small. By the radiation of heat into the air at night the leaves of plants become colder than the surrounding atmosphere, and finally, if the conditions are favorable, their temperature sinks below that of the dew-point, and the moisture of the atmosphere is condensed upon them in the form of dew.

Over a country denuded of forests the air is dry, for the trees are not there to draw up from the subsoil, even 20 feet below the surface, moisture to be contributed to the surrounding air through the many evaporating surfaces. The air becomes thirsty, as it were, and, in the absence of other moisture, parches and cracks the earth's surface and evaporates the waters of its lakes and rivers.

The effect of tree destruction is not better illustrated than in the old world along the shores of the Mediterranean. This was once the garden region of the world; then it was protected by its trees. Since their destruction much of it has become an unproductive desert. Even in our own country the harm is already apparent in many sections. The streams have become smaller and the ground is less fertile than it was. In the great pine-producing states of the north—Michigan, Wisconsin and Minnesota—the destruction during the last twenty years has been almost incredible. From the forests of Michigan in 1881 about 4,000,000,000 feet of lumber was manufactured, not including great quantities of square timber, shingles, staves, laths, etc. The trees destroyed that year brought in a revenue of about $80,000,000. The result of the wholesale destruction is already apparent in the thousands of acres of fire-blackened pine-barrens, and in the deserted cities which owed their growth and life to the lumber trade.

The pioneers of the east found too many trees, but the settlers of the great plains of the west very soon found out that trees were a necessity and forthwith began growing them. In the states in the east it is time something was done to preserve the remaining forests. Good farmers know that there is profit in keeping a portion of their land in timber, but on the other hand many of the selfish and ignorant, intent only upon present gain, will persist n the wholesale destruction of timber, without a thought to the effect upon the future prosperity of the community. Protection lies in the enactment of wise forestry laws by the several states. It is believed that by such means will it be possible to preserve the forest trees and foster their growth in a degree adequate to the needs of our country.

GRASSES AND FORAGE PLANTS.

The recent determination of Secretary Morton to secure the services of a capable agrostologist, whose entire time should be devoted to the subject of grasses, has resulted in the selection of Prof. Frank Lamson-Scribner, who has accepted the position offered to him.

There are no means for estimating with any degree of accuracy the total value of the grass production of this country, but the value of the average hay crop exceeds $400,000,000, and while no data are available to estimate the annual value of the pasture lands, it is clear that, added to the hay value, a total grass product will result probably more valuable than any other single crop in the country. The importance of collecting and imparting useful information regarding our grasses is therefore evident. The duties of the agrostologist are thus summarized in a letter in which the place was tendered to Professor Scribner. * * * "The identification of grasses and the investigation of forage plants in this department. * * * * To prepare monographs on grasses; care for the grasses of the herbarium; to identify such as may be sent here for that purpose; to conduct correspondence on this subject, and to have charge of any special investigation of grasses and forage plants which may be undertaken by this department."

The manner of Professor Scribner's selection for the place testifies strongly to the high place he holds in the estimation of the leading botanists in the country. As soon as the creation of the place was decided upon, letters were addressed to twenty-four of the leading botanists in the country, advising them of this intention, and they were invited to suggest the names of persons whom they regarded as best fitted for the place. Ten of the parties so addressed replied recommending Prof. Lamson-Scribner, and four others speak of him as the right man, provided his services could be secured. Among those highly recommending Professor Scribner are: Prof. Charles E. Bessey, of University of Nebraska, who speaks of him as the "one person above all others whose services the department should secure if it is possible." Dr. J. Bernard Brinton, of Philadelphia, who pronounces him "the best grass expert in the United States." Prof. N. L. Britton, Columbia College, New York, who says "the scientific knowledge of grasses possessed by Prof. Frank Lamson-Scribner is greater than that of any other American botanist." Dr. John M. Coulter, president of Lake Forest University, Ill., says "probably the best equipped man in the country." Prof. W. G. Farlow, of Harvard University, says "in my opinion the person having the largest and most accurate knowledge of grasses among North American botanists." Professor Hitchcock, of Kansas State College, says "probably the best equipped man for the position." Mr. Thomas Meehan, Germantown, Pa., says "the best fitted person in

the Union for 'grass man' in your department." A number of others speak of Prof. Lamson-Scribner in the same or at least equally laudatory terms. Upon such recommendations Secretary Morton promptly tendered the place to Professor Scribner, through Assistant Secretary Dabney, and after some correspondence the professor concluded to accept and his appointment has been made out.

Prof. Scribner, who is now director of the Tennessee Agricultural Experiment Station and botanist, was born in Massachusetts in 1851. His family name was Lamson, but having early lost his parents he was adopted into a family of the name of Scribner, living near Augusta, Maine; and there he was brought up. From his youth Prof. Scribner, showed his natural bent for botanical pursuits. At the age of 18, while still on the farm, he prepared a treatise on the "Weeds of Maine," an illustrated pamphlet of 62 pages, prepared for the State Board of Agriculture, and his first botanical collections, made in 1866-67, were acquired by Bowdoin College.

In 1870 he entered the State College of Agriculture and the Mechanic Arts at Orno, from which institution he graduated in 1873 with the degree of B. S. In May, 1885, Professor Scribner was appointed assistant botanist in the Department of Agriculture and later became chief of the section of vegetable pathology. Professor Scribner is a member of a number of scientific societies and in 1889 he received from the French government, for his services in matters pertaining to viticulture and the diseases of the vine, the Chevalier's Cross of the Order of Mérite Agricole. He has written extensively upon botanical subjects and especially on grasses and has one of the largest private collections of grasses in the country, numbering nearly 5,000 specimens.

MAY'S PAST WEATHER RECORD.

DES MOINES—15 YEARS' RECORD.

TEMPERATURE—Mean or normal, 60°. The warmest May was that of 1880, with an average of 67°. The coldest May was that of 1898, with an average of 54°. The highest temperature during any May was 94° on the 21st. 1886. The lowest temperature during any May was 28° on the 7th, 1885. The average date on which last "killing" frost occurred (in spring), April 28th.

PRECIPITATION—Average for the month, 4.04 inches. Average number of days with 01 inch or more, 12. The greatest monthly precipitation was 9.76 inches in 1883. The least monthly precipitation was 1.70 inches in 1885, The greatest amount of precipitation recorded in any twenty-four consecutive hours was 2.91 inches on the 8th and 9th, 1883. A trace of snow fell on the 20th, 1892.

CLOUDS AND WEATHER—Average number of clear days, 9; average number of partly cloudy days, 11; average number of cloudy days, 11.

WIND—The prevailing winds have been from the northwest. The highest velocity of the wind during any May was 46 miles on the 10th, 1889, from the north.

DAVENPORT—22 YEARS' RECORD.

TEMPERATURE—Mean or normal, 60°. The warmest May was that of 1881, with an average of 68°. The coldest May was that of 1882, with an average of 54°. The highest temperature during any May was 90°, on the 9th, 1887. The lowest temperature during any May was 29°, on the 7th, 1885. Average date on which last "killing" frost occurred (in spring), April 25th.

PRECIPITATION—Average for the month, 4.49 inches. Average number of days with .01 of an inch or more, 13. The greatest monthly precipitation was 1.34 inches, in 1881. The greatest amount of precipitation recorded in any 24 consecutive hours was 2.79 inches on the 18th, 1876.

CLOUDS AND WEATHER—Average number of clear days, 9; average number of partly cloudy days, 13; average number of cloudy days, 9.

WIND—The prevailing winds have been from the southwest. The highest velocity of the wind during any May was 60 miles on the 4th, 1888.

DUBUQUE—20 YEARS' RECORD.

TEMPERATURE—Mean or normal, 60°. The warmest May was that of 1881, with an average of 69°. The coldest May was that of 1882, with an average of 54°. The highest temperature during any May was 94°, on the 28th, 1874. The lowest temperature during any May was 26°, on the 7th, 1885. Average date on which last "killing" frost occurred (in spring), April 28th.

PRECIPITATION—Average for the month, 4.17 inches. Average number of days with .01 of an inch or more, 13. The greatest monthly precipitation was 9.18 inches, in 1892. The least monthly precipitation was 1.08 inches, in 1874. The greatest amount of precipitation recorded in any 24 consecutive hours was 3.18 inches, on May 9th, 1890 A trace of snow was recorded on the 4th, 1891.

CLOUDS AND WEATHER—Average number of clear days, 8; average number of partly cloudy days, 12; average number of cloudy days, 11.

WIND—The prevailing winds have been from the southeast. The highest velocity of wind during any May was 31 miles, on the 11th, 1893.

KEOKUK—22 YEARS' RECORD.

TEMPERATURE—Mean or normal, 63°. The warmest May was that of 1881, with an average of 70°. The coldest May was that of 1882, with an average of 57°. The highest temperature during any May was 92°, on the 24th and 27th, 1874. The lowest temperature during any May was 29°, on the 2d, 1875. Average date on which last "killing" frost occurred (in spring), April 9th.

PRECIPITATION—Average for the month, 4.04 inches. Average number of days with .01 inch or more, 11. The greatest monthly precipitation was 7.11 inches, in 1882. The least monthly precipitation was 1.35 inches, in 1881. The greatest amount of precipitation recorded in any 24 consecutive hours was 2.87 inches, on the 17th, 1889. A trace of snow fell on May 6, 1890.

CLOUDS AND WEATHER—Average number of clear days, 7; average number of partly cloudy days, 15; average number of cloudy days, 9.

WIND—The prevailing winds have been from the south. The highest velocity of the wind during any May was 48 miles, on the 19th, 1892, from the northwest.

LA CROSSE, WIS.—21 YEARS' RECORD.

TEMPERATURE—Mean or normal, 59°. The warmest May was that of 1881, with an average of 68°. The coldest May was that of 1888, with an average of 52°. The highest temperature during any May was 96° on the 27th, 1874. The lowest temperature during any May was 29° on the 2d, 1874, and on the 7th, 1890. Average date on which last "killing" frost occurred (in spring), May 20th.

PRECIPITATION—Average for the month, 3.27 inches. Average number of days with .01 inch or more, 11. The greatest monthly precipitation was 7 06 inches in 1892. The least monthly precipitation was .50 inch in 1887. The greatest amount of precipitation recorded in any twenty-four consecutive hours was 1.76 inches on the 3d, 1888.

CLOUDS AND WEATHER—Average number of clear days, 9; average number of partly cloudy days, 13; average number of cloudy days, 9.

WIND—The prevailing winds have been from the south. The highest velocity of the wind during any May was 45 miles on the 22d, 1890.

BELATED REPORTS.

Following reports were received too late for publication in last month's Review:

FAYETTE—(December). Mean temperature, 17.3°; maximum, 50°, on the 24th; minimum, 13° below zero, the 13th. Total rainfall, 1.24 inches. Total snowfall, 6 inches. Prevailing wind, from the northwest. Number of clear days, 8; part cloudy, 8; cloudy, 15; rain or snow fell on 11 days.

FAYETTE—January, 1894. Mean temperature, 17.6°; maximum, 55°, on the 17th; minimum, 27° below zero, on the 25th. Total rainfall, 1.08 inches. Total snow, 9.5 inches. Prevailing direction of wind, northwest. Number of clear days, 9; part cloudy, 11; cloudy, 11; rainy, 7.

FAYETTE—February, 1894. Mean temperature, 17.6°; maximum temperature, 48°, on the 27th; minimum temperature, 15° below zero, on the 4th. Total rainfall, 0.35 inches. Total snowfall, 3.3 inches. Prevailing wind, northwest. Number of clear days, 18; part cloudy, 4; cloudy, 6; number of days on which .01 inch or more rain fell, 3

CENTERVILLE—February, 1894. Mean temperature, 25.2°; maximum temperature, 60° on the 28th; minimum temperature, 3° below zero on the 22d. Total rain or melted snow, 1.3 inches. Total snowfall, 13 inches. Prevailing wind, northwest. Number of clear days, 21; partly cloudy, 4; cloudy, 3. Days on which .01 or more inches of rain or snow fell, 2.

MARCH WEATHER REPORT.

The month of March, 1894, was a record breaker in respect to temperature. The daily mean temperature of the first and second decades was about 15° above the normal—the warmest on record in Iowa. The last decade was the coldest on record, the daily mean being 10° below the normal for that period in March. The daily average for the entire month was about 10° above the normal. Farm operations were begun at least three weeks earlier than in the average of recent years, and before the 21st more than half the usual amount of small grain was sown. All forms of vegetation were quickened and began to show signs of life. But the last week brought a most damaging change, and the full extent of loss of fruit and grain crops cannot as yet be determined. The mean temperature for the State was 41°.

The average precipitation, 2 03 inches, was the normal amount for March. On the whole the month brought less than an average amount of atmospheric disturbance and severe storms. It was an exceptionally warm and pleasant March.

The following table gives, as a basis of comparison, the mean temperature and total precipitation for the month of March, at the stations named, for the years from 1872 to 1894, inclusive:

YEARS.	MEAN TEMPERATURE, DEGREES.						PRECIPITATION, INCHES.					
	Des Moines.	Davenport.	Dubuque.	Keokuk.	Omaha.	Sioux City.	Des Moines.	Davenport.	Dubuque.	Keokuk.	Omaha.	Sioux City.
1872	....	32	....	35	31	....	.....	1.82	.....	2.88	1.61	.....
1873	....	36	....	38	38	....	.....	1.43	.....	0.51	0.44	.....
1874	....	34	33	38	34	...	.....	1.84	1.28	1.14	1.49	.....
1875	....	30	28	34	31	....	.....	0.88	1.45	1.67	1.24	.....
1876	.	32	31	35	29	....	.....	4.35	4.00	3.45	3.18	.....
1877	....	29	27	32	34	....	.....	3.91	4.53	3.76	1.26	....
1878	...	48	45	50	48	..	.....	2.21	2.44	3.78	3.09	...
1879	40	40	37	42	41	..	1.68	1.80	1.20	1.71	2.17	.....
1880	37	37	36	40	36	..	0.70	2.68	2.55	1.83	0.50	.....
1881	29	29	30	34	28	....	1.78	3.33	3 78	2.42	0.72	.....
1882	38	40	37	42	40	....	2.28	2.90	1.49	3.30	0.79	.....
1883	33	35	31	36	35	....	0.57	0.73	0.32	1.07	0 52	.....
1884	35	36	32	37	35	....	2.24	3.27	3.85	3.37	4.91	.....
1885	34	34	30	35	36	....	0.04	0.17	0.41	0.17	0.33	.....
1886	35	33	31	37	32	....	1.41	3 08	4.32	2 25	1.31	.....
1887	36	34	32	40	38	....	1.79	0.77	1.80	0.76	0.43	.....
1888	29	30	27	25	29	....	3.09	2.70	3.44	3.45	3.28	.....
1889	39	39	39	43	40	..	0.11	1.74	0.30	1.04	0.53	.....
1890	30	30	28	33	33	28	0.91	2.34	1 68	2.43	1.35	2.12
1891	29	29	28	31	29	25	2.25	1.68	2.69	2.27	2.26	2.01
1892	34	34	31	36	34	32	2.47	3.06	1.91	2.91	2.74	1 16
1893	33	34	32	37	34	29	1.15	2.25	2.52	2.66	1.29	1.43
1894	43	43	41	46	43	40	1.78	1 88	3.06	2.52	0.91	0.64
Means	35	35	32	38	35	31	1.55	2.18	2.30	2.17	1.52	1.45

SUMMARY OF WEATHER CONDITIONS.

BAROMETER—Mean pressure for the month 30 00 inches, Highest observed 30.75, at Clarinda and Omaha, on the 6th-26th. Lowest observed 29.46 inches, at Dubuque and Sioux City, on the 10th. Range for the month, 1.46 inches.

TEMPERATURE—Monthly mean as determined from sixty-eight voluntary observers' reports, 41 0°. Highest monthly mean 4 84°, at Ft. Madison. Lowest monthly mean 34.3°, at Osage. The highest temperature reported 84°, at Logan, on the 17th. Lowest temperature reported was 5 below zero, at Larrabee, Sibley and Spirit Lake, on the 25th. The average daily maximum, 52 7°; average daily minimum, 29.9°; average monthly maximum, 79.7°; average monthly minimum, 2.6°. Greatest monthly range 87°, at Larrabee; least monthly range 67°, at Mt. Pleasant. Total range for the State, 89°.

PRECIPITATION—Average for the State, as determined

from seventy-three voluntary observers' reports, 2.03 inches. The greatest amount reported was 4.52 inches at Cedar Rapids. The least amount reported was 0.26 inches at Murray. The average number of days on which .01 or more inches of rain or snow fell was 6.5; clear days, 12.8; partly cloudy days, 10.3; cloudy days, 7.9.

SOLAR HALOS—Amana, 14th, 27th, 28th.

LUNAR HALOS—Amana, 15th, 17th; Alta, 15th, 17th.

SLEET—Independence, 22d; Williams, 22d.

METEOR—A brilliant meteor was observed in the southeast and east portion of the State on the 27th.

AURORAS—College Springs, 7th; Davenport, 30th; Delaware, 30th; Keokuk, 30th; Mechanicsville, 30th; Ottumwa, 30th Oskaloosa, 30th; Alta, 30th; in shape of extensive band of bright diffused light reaching nearly to zenith with heavy dark segment.

THUNDER STORMS—Very general throughout the State on the 14th and 18th.

HAIL—Amana, 14th; Galva, 4th; Monticello, 4th; Winterset, 14th.

EARLY BIRDS—Ducks and geese, brant, cranes, blue birds and robins were noticed throughout the State early in March.

HIGH WINDS—Amana, 10th; Greenfield, 24th; Hampton, 24th; Hopkinton, 10th, 24th; Maxon, 10th, 24th; Spirit Lake, 24th; Tipton, 10th; Alta, 16th, 17th, 24th, 25th, 30th 31st.

ATMOSPHERIC PRESSURE.

STATIONS.	Mean reduced barometer.	EXTREMES.			
		Highest barometer	Date.	Lowest barometer	Date.
Cedar Rapids	30.05	30.64	4	29.60	14
Clarinda	30.02	30.75	26	29.53	17
Cresco	30.06	30.64	26	29.48	10
Davenport	30.00	30.58	26	29.52	10
Des Moines	30.00	30.68	26	29.48	10
Dubuque	29.99	30.56	26	29.46	10
Keokuk	30.01	30.61	26	29.62	20
La Crosse	29.97	30.59	26	29.29	10
Omaha (Neb)	30.02	30.75	26	29.47	10
Sioux City	29.97	30.73	6	29.46	10
Extremes		30.75	26	29.29	10

WIND MOVEMENT.

STATIONS.	Miles.	Maximum velocity.	Direction.	Date.
Davenport	9,320	60	SW	10
Des Moines	8,209	42	SW	10
Dubuque	5,494	40	W	10
Keokuk	6,981	42	W	19
La Crosse (Wis)	7,394	38	S	11
Omaha (Neb)	7,666	32	NW	28
Sioux City	10,633	42	NW	10

OBSERVERS' NOTES.

Clinton—LUKE ROBERTS, M. D.: March, 1894, was remarkably warm. The mean temperature was 41.3 degrees, which is 8 7 degrees above normal. In 1889 March was also above normal by 6.7 degrees. Quoting from Monticello, Jones county, record, which has been running forty years, we find that March, 1878, gave the highest mean temperature for the period. Therefore, March, 1894, has been exceeded but once in high mean temperature during the last forty years. The first two decades gave a mean temperature of 45.4 degrees, which is 8.2 degrees higher than the next highest (1889) for the corresponding period during the last sixteen years.

The highest temperature for the month was 80 degrees, occurring on the 17th. This is a higher temperature than before reached in March since my record commenced. The minimum temperature was 3 degrees above zero and occurred on the 29th. The normal minimum temperature is 1.2 degrees above zero.

The warmest day was the 17th and the mean temperature 65.2°, being 16.2° above normal for like days. The coldest day was the 25th, with a mean temperature of 14.8°, which is 3.3° above normal. The mean temperature for the coldest day of the cold March of 1890 was 6.5° below zero.

Up to and including the 24th, March was more like April weather, and many thought that seed time had surely come, and they were about to make gardens and set cabbage, tomato and sweet potato plants. Farmers were plowing and many sowed oats. Much attention was given to putting yards and lawns in order, sowing grass seed, etc.

The Mississippi river opened for navigation on the 6th and some steamboats were put in service, while others hurried to get ready for the season's business. The river cleared of ice earlier than usual.

There were seven storm days, six of which were rain and one snow. Total precipitation was 2.80 inches. This was a slight increase above March average. The snowfall was on the 28th, commencing very early in the morning and continued until 4:30 P. M.—depth of snow, five inches. The next morning was the coldest in the month, being only 3° above zero. The cold days of the month were the 25th, 26th, 27th and 29th. The 28th moderated so as to deposit the "beautiful snow."

The movement of the wind was about normal, and its prevailing direction from the southwest and south. Total movement, 6,200 miles.

The 10th was a clear and warm day, but the wind blew lively, attaining a velocity of thirty-one miles an hour about 8 o'clock P. M.

The 24th was mostly clear, but chilly, the wind being uncommonly lively. It started in, business like, early in the morning, and at 7 o'clock was going at a speed of twenty-three miles an hour and kept going better until it reached its limit of thirty-three miles an hour. Its energy held out well until after noon of the next day. This was the greatest velocity for a March wind since 1885, when it did forty miles. March, 1882 was the same.

On the 14th rain, thunder and lightning commenced at five minutes past 7 P. M., and ceased about midnight Much thunder and lightning prevailed with several very heavy reports, and the flashes of lightning were at times very dazzling and intense. Hail was an accompaniment for a few minutes between five and ten minutes past 9 P. M.

On the evening of the 30th a fine aurora was in progress for about two hours. It was a little unusual in its behavior. It seemed to manifest itself along the horizon from the northwest to the northeast. In the center or for a wide space to the north it was of a cream or light smoke color diffused, and with pulsating movements which were upward and reaching the zenith passed it to the south by west. To the east and northeast the aurora took the form of streamers tinged with crimson and green. The most beautiful portion was from the northwest where the streamers rose from a broad base, and with crimson and pink and other delicate shadings, reached the zenith and passed it to the southeast.

Postville—F. L. WILLIAMS: Since reading the newspapers I am satisfied that the flash I saw about 8 P. M., on the 27th, was the meteor reported instead of lightning. The sound after the flash, that I mistook for thunder, was very low.

Monticello—H. D. SMITH: In the storm of the 14th, a hay barn belonging to J. A. McLaughlin, about four and one-half miles northwest, was struck by lightning about 8:30. Robins and blue birds were here on the 3rd; first plowing of sod on the 5th; oats sowing begun 16th; potatoes planted 22nd. Maximum temperature for March for forty years 78° in 1875; minimum, 16° in 1890; normal for March, 32°; highest precipitation in March, 6.54 inches in 1877; lowest, .07 in 1869; normal, 2.44 inches.

College Springs—A. A. BERRY: First part of month fine weather, and farmers sowing grain and making garden and planting potatoes, but on the 26th the thermometer registered zero, which was not the best condition for oats one inch high. It is hard to tell how much will have to be replanted. Do not think fruit buds were far enough advanced to be injured much by the frost.

Dubuque—S. C. EMERY: The 17th was the warmest March day in forty years.

Delaware—WILLIAM BALL: The aurora on the 30th was very brilliant at 7:30 P. M. though partly obscured by clouds, the streamers reaching to the zenith, and were at times greenish white in the northeast and crimson in the northwest.

Ovid—H. C. MILLER: First three weeks of March the warmest ever known here. Soft maple in bloom on the 13th, elms on the 16th. Oats nearly all sown before the 24th. Potatoes planted and gardens made but the freezing weather of the past week spoiled it all.

A new voluntary meteorological station has been established at Albia, Monroe county, under the management of Cal. Koontz. Mr. Koontz is supplied with self-registering thermometers, rain gauge, etc., and this office will receive and publish his monthly report of temperature, rainfall, snowfall, state of weather and direction of the wind.

Mr. J. A. Peters, at Forest City, has been supplied with a set of self-registering thermometers, rain gauge, measuring sticks, etc., and will render regular reports for the MONTHLY REVIEW hereafter.

METEOROLOGICAL DATA FOR MARCH, 1894.

STATIONS.	TEMPERATURE OF THE AIR (IN DEGREES FAHRENHEIT).								PRECIPITATION IN INCHES.			Prevailing direction of wind.	No. of cloudless days.	No. of partly cloudy days.	No. of cloudy days.	No. of rainy days. (.01 inch or more).	No. of thunder storms.
	Monthly mean.	EXTREMES. Mean maximum.	Mean minimum.	Maximum.	Date.	Minimum.	Date.	Monthly range.	Monthly.	Total snowfall.	Depth of unmelted snow at end of month.						
Algona	37.9			79	17	0	25	79	1.57	3.8		NW	9	13	9	6	2
Alta	37.3	48.5	26.6	82	17	-4	25	86	.75	2.0		NW	13	12	6	8	3
Ames (ex. station)									1.49							7	
Amana	41.1	51.3	30.9	78	17	4	25	74	2.92	2 0		S	15	10	6	8	3
Atlantic	42.1	56.7	27.5	84	17	4	26	80	1.43			S	11	12	8	4	
Audubon	41.1	53.6	28.6	81	17	1	26	80	1.09			S	2	17	12	3	
Belle Plaine	40.7	51.8	29.5	78	17	3	25	75	3.05	4.0		S	13	9	9	7	
Bonaparte	44.5	56.9	32.2	80	17	7	26	73	2.51							5	
Carroll	38.5	50.5	26.5	82	17	0	25	82	1.76	T			7	7	7	5	1
Cedar Falls	39.4	50.3	28.6	80	17	2	25	78	.98	5.0		S	13	8	10	6	3
Cedar Rapids	42.5	50.4	34.6	75	17	6	25	69	4.52	2.7		S, NW	19	6	6	10	1
Centerville	45.7	61.2	22.2	75	22	3	27	72	2.15	T		S W	21	5	5	4	1
Charles City	36.7	45.2	28.1	78	17	1	25	79	1.95	4.9		NW				7	1
Clarinda	41.8	53.5	30.1	81	17	5	25	76	1.17	T		NW	18	6	7	4	
Clinton	42.6	53.7	31.4	80	17	3	29	77	2.80	5.0		SW	12	12	7	7	
College Springs	39.8	55.7	29.7	83	17	0	26	83	1.46			S	16	5	10	3	
Corning	43.2	56.4	30.9	82	17	4	26	78	.84	T		NW	19	6	6	5	
Cresco	35.7	45.5	25.9	76	17	2	29	74	2.57	3.5		NW	10	13	8	11	
Davenport	43.0	52.0	34.8	78	17	6	25	72	1.88			SW	8	15	8	8	3
Decorah	37.4	47.3	27.4	77	17	3	25	74	2.93	5 0			10	9	12	8	
Delaware	37.1			78	17	4	25	74	2.71	2.5		S	13	7	11	7	2
Des Moines	43.0	52.7	32.6	81	17	4	25	77	1.78	3.0		SW	15	9	7	8	3
Dubuque	41.4	50.4	32.3	78	17	7	25	71	3.06			SE	9	13	9	7	3
Elkader	39.6	50.7	28.4	75	21	3	29	72	2.73	5.0		N	11	8	6	9	4
Ft. Madison	48.4			80	17	12	25	68	.90			SW	6	17	8	3	
Galva	39.6	51.6	27.5	82	17	-2	25	84	.57			NW	11	12	8	9	1
Glenwood	46.3	62.0	30.7	82	13	-4	25	86	1.12			S	16	9	6	4	
Grand Meadow	38.1			78	17	5	25	73	3.45	3.0		S	4	20	7	11	1
Greenfield	42.8	56.3	29.3	83	17	1	26	82	1.45	T		S	7	14	10	7	3
Grinnell	42.8	53.0	32.6	78	17	5	25	73	3.47	1.2		NW	12	11	8	6	
Grundy Center	38.1	50.2	26.0	78	17	0	24	78	2.40	4.0		S	17	10	4	5	3
Hampton	37.5	48.4	26.5	79	17	-1	25	80	2.23	6.1		NW	11	17	3	9	2
Hopeville	42.2	54.0	31.0	80	17	4	26	76	1.82	T		NW	3	22	6	4	3
Hopkinton	42.4			75	17	8	26	67	3.18	2.0		SE				7	3
Humboldt									1.69	2.0		S	11	14	6	8	
Independence	40.4	50.6	30.3	78	17	3	25	75	3.25	6.0		S	15	11	5	8	
Indianola	44.4	57.1	41.8	81	17	4	25	77	.99	T		NW	13	7	11	4	
Iowa City	43.8	55.6	31.9	81	17	5	26	76	2.33	3.0		NW	3	21	7	6	
Iowa Falls	37.5	49.9	25.1	78	8	3	25	81	1.95	6.0		S	16	6	9	7	
Keokuk	46.0	56.2	36.1	79	21	8	28	71	2.52			W	15	8	8	8	4
North McGregor									2.32							7	
Keosauqua	45.7	57.4	34.0	84	17	9	25	75	3.05								
Knoxville	42.0	52.4	31.5	80	17	4	25	76	2.57			SW	10	11	10	5	
Larrabee	37.4	49.7	25.1	82	17	-5	25	87	1.14				9	12	10	6	
Logan	41.0	54.0	27.9	85	17	3	25	82	.40			SW	17	4	10	1	1
Le Claire									2.27								
Maxon	41.9			79	17	2	25	77	2.24				3	23	5	5	4
Mechanicsville	40.3	50 0	30.5	75	10	4	25	71	3.51	6.0		W, S	16	6	9	6	2
Monticello	38.4	47.8	29.1	76	17	3	25	73	3.84	4.0		S	19	7	5	9	3
Mt. Pleasant	45.6			77	17	10	25	67	2.34	T		SW	20	4	7	8	
Mt. Vernon	40.4			79	17	3	26	76	3.05								
Murray									.26								
Newton	41.9	54.5	29.3	79	17	2	25	77	2.21	2.5		S	21	5	5	7	
Omaha (Neb.)	43.0	53.6	32.4	84	17	4	25	80	0.91			NW	9	10	12	6	
Osage	34.3								1.85	4.5		S	9	12	10	8	2
Oskaloosa	43.1	55.0	31.2	80	17	6	25	74	2.21	1.4		SW	19	4	8	9	
Ovid	43.2	55.2	31.3	80	17	5	25	75	2.36	T		NW	12	7	12	7	3
Ottumwa	42.1	54.7	29.5	82	17	2	25	80	0.62	T		SW	14	8	9	3	
Panama	44.8	56.4	33.1	81	17	6	25	75	2.36	1.8		W	13	9	9	6	
Richland	41.3			84	17	4	25	80	2.61	3.5			1	27	3	7	1
Rockwell City									1.35				21	4	6	5	
Sac City	37.5	46.4	28.6	82	17	-2	25	84	1.15	1.5		SW	8	16	9	4	
Seymour	44.5	56.7	32.5	80	17	-5	25	85	0.72			NW	21	5	5	4	
Sibley	37.2	49.9	24.5	80	17	-5	25	85	1.01	2.5		NW	17	9	10	6	
Sioux City	40.0	51.1	29.1	82	17	0	25	82	0.64			NW	11	11	9	7	
Spirit Lake	38.1	50.7	25.5	82	17	-5	25	87	1.17	4.0		S	13	5	13	6	
Tipton	42.2	55.5	31.2	79	17	5	25	74	3.38	3.0		SW	20	3	8	6	4
Toledo	40.9	51.0	30.8	82	17	2	25	80	2.53	3.0		NW	15	3	13	6	
Vinton	40.3								2.41	4.0	S	W, NW	20	7	4	8	1
Washington	42.0			82	17	6	25	76	2.97			SW				8	
Webster City	37.8			80	17	0	25	80	1.70	2.4		SE	15	10	6	5	1
West Bend	37.1			80	17	-4	25	84									
Williams	37.4								1.62	3.0		W	13	12	6	6	5
Winterset	42.0	53.0	30.2	81	17	3	25	78	2.76	T		NW, S	8	13	10	5	
Means	41.0	52.7	29.9	79.7		2.6		77.3	2.03	2.7		S	12.8	10.3	7.9	6.5	

DAILY AND MONTHLY MEAN TEMPERATURE FOR MARCH, 1894.

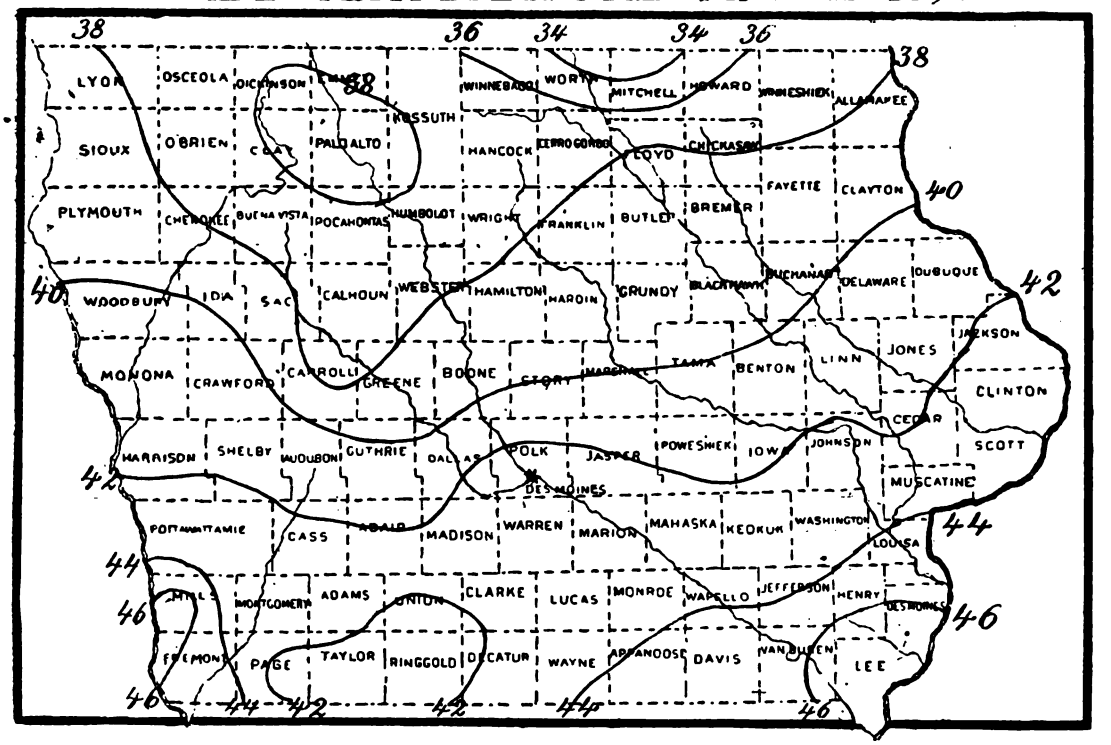
STATIONS.	DATE.																															Monthly Mean.
	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	31st.	
Algona	38	40	56	56	28	31	30	38	46	40	40	51	47	41	36	53	66	39	42	45	49	30	38	12	7	16	30	18	31	50	36	37.9
Alta	40	41	51	58	28	30	34	34	46	44	39	47	44	39	39	52	66	36	39	43	52	27	31	18	6	12	25	20	26	51	40	37.3
Albia	....	....	....	....	....	....	....	....	....	....	....	....	....	....	43	51	60	49	51	52	59	34	40	29	13	15	25	24	24	46	47	43.0
Amana	43	38	52	56	46	32	38	32	46	56	42	47	44	40	44	48	64	52	46	50	62	40	39	24	12	18	24	28	22	44	48	41.1
Atlantic	43	40	57	56	40	34	36	38	46	50	42	48	46	43	43	52	69	54	49	48	60	35	38	28	14	18	24	29	28	50	45	42.1
Audubon	43	40	56	56	41	32	36	37	47	49	41	52	46	43	40	52	67	54	45	46	58	34	36	26	10	14	24	28	27	50	44	41.1
Belle Plaine	44	38	52	56	44	31	36	36	45	56	42	47	42	40	44	48	64	52	46	49	62	38	40	22	11	17	24	25	22	44	46	40.7
Bonaparte	44	42	54	58	48	34	39	34	48	57	44	47	48	42	47	50	64	64	51	60	66	48	40	34	16	22	30	29	26	42	51	44.5
Carroll	41	49	53	45	29	30	36	33	45	44	47	50	46	40	42	53	64	45	45	42	56	27	34	16	10	10	24	20	24	50	42	38.5
Cedar Falls	44	37	50	50	41	34	35	34	45	54	42	46	44	38	42	46	64	47	43	45	57	34	38	22	12	18	23	29	22	44	44	39.4
Cedar Rapids	44	41	53	56	50	32	34	36	46	58	42	47	50	42	44	48	64	56	50	50	63	38	40	28	14	19	27	31	23	44	46	42.5
Centerville	40	38	38	39	46	50	51	54	50	54	54	52	53	53	55	54	54	52	52	54	54	59	60	35	33	19	20	28	33	38	45	45.7
Charles City	42	38	52	55	30	28	35	31	44	50	39	45	37	38	41	48	58	40	42	42	50	32	35	20	10	11	22	23	18	42	42	36.7
Clarinda	41	42	54	57	39	34	36	38	48	50	43	52	48	46	44	53	68	52	46	50	54	31	38	20	12	16	28	30	30	47	48	41.8
Clinton	42	38	50	55	51	37	38	34	46	58	42	42	44	39	44	47	64	60	47	50	64	52	40	30	20	20	25	30	20	42	48	42.6
College Springs	43	46	54	57	37	32	36	38	51	50	42	54	47	44	44	55	68	56	46	48	60	33	38	26	16	15	29	30	32	48	51	42.7
Corning	44	42	58	57	42	33	40	38	48	53	42	50	50	44	43	54	68	51	46	50	62	37	38	32	14	17	26	29	28	50	51	43.2
Cresco	39	36	50	51	33	28	30	30	40	48	37	42	39	35	38	44	62	50	38	39	53	36	33	18	10	16	22	21	16	34	39	35.7
Davenport	42	42	54	56	54	34	40	36	48	61	44	48	48	41	46	50	66	58	48	56	65	42	38	28	12	18	26	31	24	44	50	43.0
Decorah	41	38	51	48	41	30	32	31	42	52	40	42	42	35	40	43	58	50	40	40	55	45	34	16	13	14	22	20	24	40	41	37.4
Delaware	36	35	49	52	43	29	32	31	42	46	38	40	40	36	38	44	62	52	40	44	58	37	34	19	10	15	24	26	18	40	40	37.1
Des Moines	46	42	57	58	38	32	39	38	50	55	44	52	49	44	45	54	68	50	47	51	63	32	40	24	12	18	26	25	28	49	50	43.0
Dubuque	42	39	53	54	50	34	38	35	45	60	42	46	46	38	42	48	64	56	43	44	60	42	37	26	12	18	24	31	22	39	47	41.4
Elkader	44	38	52	54	44	33	34	33	44	56	42	45	42	38	42	46	66	52	42	43	60	38	37	22	12	18	23	28	20	40	44	39.6
Ft. Madison	45	39	54	59	50	44	39	37	52	53	44	49	50	49	49	55	66	61	54	62	65	44	45	33	26	22	32	34	33	49	52	46.6
Galva	40	41	52	57	40	31	35	32	36	42	40	45	44	40	48	50	66	53	40	44	54	38	30	27	8	13	28	30	28	53	49	39.6
Glenwood	49	47	61	60	42	34	45	42	57	54	47	55	63	47	46	..	63	55	48	56	60	37	44	31	14	20	34	31	31	65	52	46.4
Grand Meadow	40	40	54	53	38	31	32	34	43	48	40	44	38	36	38	39	66	48	40	41	52	37	37	20	12	18	28	26	24	45	39	38.1
Greenfield	42	44	56	58	41	35	37	39	47	56	43	49	48	44	43	55	68	54	47	48	62	36	38	29	13	16	28	28	27	49	48	42.8
Grinnell	43	42	53	46	44	30	34	38	47	59	44	48	44	45	46	54	64	58	44	48	64	48	38	32	10	16	26	30	26	46	48	42.8
Grundy Center	38	40	53	54	34	30	32	35	45	49	42	47	38	41	42	50	65	47	42	46	50	32	32	14	11	16	26	17	24	46	40	38.1
Hampton	42	38	50	54	30	28	34	32	43	52	40	47	37	38	40	47	66	42	39	45	48	32	35	16	8	14	22	26	23	45	41	37.5
Hopeville	44	42	54	56	42	34	37	37	48	52	43	50	48	43	44	52	66	54	46	50	62	38	40	28	12	16	28	29	27	46	48	42.2
Hopkinton	42	40	48	52	52	33	38	36	46	57	42	47	45	42	44	48	64	56	44	45	62	42	38	27	16	18	26	30	22	42	47	41.5
Independence	42	38	49	54	46	31	32	34	44	58	48	45	48	37	50	46	63	54	42	44	60	40	36	26	12	16	22	30	18	41	48	40.4
Indianola	44	42	56	58	45	32	37	36	49	58	51	49	55	48	46	54	68	58	46	40	64	51	41	34	15	22	25	27	27	48	50	44.4
Iowa City	44	39	52	56	51	34	40	34	48	59	44	46	47	41	45	48	65	61	48	51	64	52	39	34	15	19	25	34	24	44	51	43.8
Iowa Falls	42	37	49	52	38	28	32	31	42	48	39	46	40	36	41	46	64	50	40	42	58	42	34	22	6	13	20	18	20	44	41	37.5
Keokuk	44	44	56	59	53	36	40	38	52	64	44	52	53	44	50	52	66	61	52	62	68	42	41	32	14	18	28	35	30	50	53	46.0
Keosauqua	46	40	54	57	54	42	40	38	48	60	46	50	50	42	48	50	68	58	51	60	66	53	43	30	16	20	28	32	28	46	52	45.7
Knoxville	44	40	56	38	40	32	35	36	47	58	44	48	52	41	43	52	67	50	46	52	65	34	40	25	12	16	25	24	26	46	50	42.0
La Crosse (Wis.)	44	41	53	52	44	30	34	33	42	56	39	45	42	36	40	46	64	52	39	40	47	38	36	17	11	17	24	31	26	42	42	39.0
Larrabee	40	42	52	47	27	30	32	34	....	44	40	48	42	42	43	51	66	46	37	42	46	30	28	24	8	13	24	23	28	53	42	37.4
Logan	42	42	56	62	38	30	34	34	46	44	42	50	52	48	42	56	70	40	46	46	56	35	32	18	10	14	26	20	30	51	56	41.0
Maxon	40	44	57	56	38	34	32	37	50	49	42	50	43	40	42	58	66	49	39	56	63	31	42	20	9	16	28	21	30	48	44	41.5
Mechanicsville	39	37	49	54	52	31	37	32	44	58	41	44	44	38	37	46	62	52	46	49	64	42	36	26	12	16	24	29	20	41	47	40.3
Monticello	38	36	48	54	42	30	32	34	43	48	36	43	38	36	40	48	66	52	42	46	62	37	36	21	12	16	26	24	21	42	40	38.4
Mt. Pleasant	49	44	57	58	55	35	38	38	50	58	42	53	50	47	47	54	72	60	51	54	68	42	42	27	16	20	29	30	28	47	54	45.6
Mt. Vernon	40	40	53	56	44	31	48	36	48	49	41	47	40	42	42	51	66	53	44	52	69	36	36	18	10	15	28	24	24	45	42	40.4
Newton	45	39	54	55	44	30	35	34	48	55	42	49	46	41	43	50	64	53	45	5	62	47	40	28	10	13	24	28	25	48	49	41.9
Omaha (Neb.)	46	48	59	60	30	35	37	41	52	51	44	54	46	48	46	59	70	42	46	50	60	30	38	23	12	16	31	23	32	54	49	43.0
Osage	34	34	48	42	30	26	32	30	40	38	34	41	34	36	37	44	59	42	40	42	48	31	33	12	6	12	22	25	19	42	36	34.3
Oskaloosa	45	40	54	60	42	34	38	36	49	56	44	50	46	44	46	52	66	54	48	52	64	46	33	24	13	18	26	24	26	48	50	43.1
Ottumwa	46	43	56	60	47	34	40	36	50	58	44	51	48	45	49	53	67	56	50	54	66	49	41	30	14	18	26	29	28	47	52	44.8
Ovid	45	42	56	58	42	34	36	37	48	61	44	51	50	44	44	52	67	50	44	54	66	34	41	27	15	18	26	24	26	47	51	43.2
Panama	42	43	55	56	42	34	34	38	48	48	42	50	48	44	44	54	68	54	45	47	62	34	36	29	10	14	26	28	28	51	49	42.1
Richland	40	42	52	56	42	34	34	36	48	50	42	50	43	44	42	53	64	51	48	55	62	35	37	18	12	16	32	24	28	46	47	41.3
Rock Rapids	27	35	46	52	....	28	34	25	45	42	39	46	50	46	50	56	60	47	39	40	36	31	30	32	8	13	12	17	24	47	37	36.7
Sac City	38	40	40	40	38	38	40	38	39	36	39	48	43	46	43	55	67	38	48	45	46	41	28	19	6	13	28	20	29	39	36	37.5
Seymour	44	44	56	59	48	34	38	37	48	57	43	50	52	42	44	53	68	58	48	56	64	50	40	36	18	16	26	30	27	45	50	44.5
Sibley	37	38	48	56	30	29	32	32	42	44	36	45	44	41	41	50	62	51	36	41	40	34	30	24	6	11	24	23	25	52	50	37.2
Sioux City	42	44	54	50	26	33	34	38	50	44	43	51	46	45	47	56	67	41	40	46	54	28	36	18	10	14	29	20	32	55	42	40.0
Spirit Lake	29	40	49	58	34	30	35	30	53	46	36	42	37	41	46	49	64	50	48	40	41	34	30	22	6	15	24	20	39	50	44	38.1
Tipton	42	40	52	56	48	34	39	30	47	52	45	48	44	41	44	48	66	56	46	48	63	49	38	32	12	19	26	28	23	45	47	42.2
Toledo	44	38	53	56	42	32	36	38	42	59	40	48	45	45	41	48	66	59	45	48	66	33	40	24	11	15	26	25	32	46	44	40.9
Vinton	41	39	53	56	38	44	32	36	47	48	40	47	40	41	41	51	64	49	44	49	62	35	37	19	12	19	28	24	25	45	43	40.3
Washington	40	40	54	58	44	33	34	36	50	48	42	49	43	44	42	51	64	52	46	53	67	37	41	22	14	18	28	27	29	46	48	42.0
Webster City	38	37	54	54	29	34	32	38	45	43	39	46	41	36	39	52	66	41	45	46	57	31	29	15	9	16	29	24	28	42	37	37.8
West Bend	....	38	52	54	28	30	29	37	43	38	34	49	37	39	38	52	63	39	45	44	48	28	35	11	6	15	27	18	28	48	34	35.3
Williams	36	39	50	54	28	30	31	34	43	43	40	51	38	44	36	52	64	40	42	45	52	30	34	14	15	14	25	22	26	48	36	37.4
Winterset	46	42	56	56	34	35	38	37	50	54	44	52	50	44	43	54	65	46	45	48	63	32	39	26	12	16	26	25	28	48	50	42.0

STATIONS.	DATE.																																	Total.
	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th	27th.	28th.	29th.	30th.	31st.	
Albia	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.26	....	0.15	0.23	T	....	....	....	....	....	0.08	....	....	....	0.72
Algona	....	....	....	0.23	T	....	....	T	....	T	....	....	....	0.05	....	....	....	0.27	....	....	0.64	0.08	....	....	....	....	....	0.30	....	....	....	1.57
Alta	....	....	....	.12	....	....	T	....	....	.02	....	....	T	.02	....	....	....	.15	....	.21	....	.05	....	T	....	....	.15	.03	....	....	....	.75
Ames Ex. station	....	....	....	0.47	0.12	....	....	....	0.05	....	....	....	....	....	0.02	....	....	0.42	....	0.29	....	....	....	....	....	....	....	0.12	....	....	....	1.49
Amana	....	....	....	0.30	1.02	0.06	....	....	....	....	....	....	....	....	0.52	....	....	0.40	....	0.17	0.22	....	....	....	....	....	....	0.23	....	....	....	2.92
Atlantic	....	....	....	0.63	0.05	....	....	T	....	....	....	....	....	....	....	....	....	0.49	....	0.26	....	....	....	....	....	....	....	....	....	....	....	1.43
Audubon	....	....	....	0.37	....	....	....	....	....	....	....	....	....	....	....	....	....	0.45	....	0.27	....	....	....	....	....	....	....	....	....	....	....	1.09
Belle Plaine	....	....	....	1.32	0.07	....	....	0.02	....	....	....	....	....	0.27	....	....	....	0.76	....	0.21	T	....	....	....	....	....	....	0.40	....	....	T	3.05
Bonaparte	....	....	....	1.37	0.16	....	....	....	....	....	....	....	....	....	....	....	....	0.75	0.06	0.17	....	....	....	....	....	....	....	....	....	....	....	2.51
Carroll	....	....	....	....	0.60	....	T	T	....	....	....	....	....	....	....	....	....	0.46	....	....	0.70	T	....	....	....	....	T	T	....	....	....	1.76
Cedar Falls	....	....	....	0.15	....	....	....	....	....	....	....	....	....	....	0.22	....	....	0.34	0.02	0.20	....	T	....	....	....	....	....	0.05	....	....	....	0.98
Cedar Rapids	....	....	....	0.54	2.06	0.31	....	....	0.03	....	....	....	....	....	....	0.30	....	....	0.49	0.16	0.02	....	T	....	....	....	....	0.25	0.36	....	T	4.52
Centerville	....	....	....	0.25	0.15	....	....	....	....	....	....	....	....	....	0 50	....	....	1.25	....	....	....	....	....	....	....	....	T	....	....	....	....	2.15
Charles City	....	....	....	0.78	0.04	....	....	....	....	0.12	....	....	....	0.05	....	....	....	0.05	0.10	0.32	....	0.05	....	....	....	0.04	....	0.40	....	....	....	1.95
Clarinda	....	....	....	0.21	0.10	....	....	....	....	....	....	....	....	....	....	....	....	0.81	....	0.05	....	T	....	....	....	....	....	T	....	....	....	1.17
Clinton	....	....	....	0.73	0.51	....	....	....	....	....	....	....	....	0.51	....	....	....	0.33	....	0.11	....	0.10	....	....	....	....	....	0.51	....	....	....	2.80
College Springs	....	....	....	....	0.55	....	....	....	....	....	....	....	....	....	....	....	....	0.82	T	0.09	T	....	....	....	....	....	....	....	....	....	....	1.46
Corning	....	....	....	0.22	T	....	....	....	....	....	....	....	....	....	....	....	....	0.40	T	0.22	....	T	....	....	....	....	....	....	....	....	....	0.84
Cresco	....	....	....	1.00	0.18	....	0.02	....	0.04	0.02	....	....	....	0.09	....	....	....	0 44	....	0.43	....	0.03	....	....	....	....	....	0.33	....	....	....	2.57
Davenport	....	....	....	0.34	0.64	0.20	....	....	T	....	T	....	T	T	0 24	....	....	0.18	T	0.03	0.01	T	T	....	....	....	....	0.24	....	....	T	1.88
Decorah	....	....	....	1.12	0.34	....	....	0.15	....	....	....	....	....	T	0.08	....	....	0.42	....	0.26	....	0.10	....	....	....	....	....	0.46	....	....	....	2.93
Delaware	....	....	....	1.57	0.16	....	....	....	....	....	....	....	....	0.26	....	....	....	0.41	....	0.26	0.03	....	....	....	....	....	....	0.12	....	....	....	2.71
Des Moines	....	....	....	0.38	0.16	....	T	....	T	T	T	....	....	0.34	0.01	....	....	0.25	T	0.22	0.11	T	T	....	T	....	T	0.31	....	....	T	1.78
Dubuque	....	....	....	0.60	0.80	T	....	....	0 01	....	....	....	....	....	0.46	....	....	0.46	....	0.20	0.04	0.01	T	....	T	....	....	0.47	....	....	0.01	3 06
Elkader	....	....	....	1.10	0.06	....	....	....	0.09	....	....	....	....	0.31	....	....	....	0.55	....	0.22	0.07	0.01	....	....	....	....	....	0.32	....	....	....	2.73
Ft. Madison	....	....	....	0.35	....	....	0.40	....	....	....	....	....	....	....	0.15	....	....	....	....	....	....	....	....	....	....	....	T	....	....	....	....	....	0.90
Forest City	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0:12	T	0.35	0.12	T	T	....	T	....	0.27	....	....	....	....	0.87
Galva	....	....	....	0.18	....	....	....	....	....	0.04	....	....	....	0.01	....	....	....	0.15	0.02	0.08	0.04	....	....	....	....	T	0.04	0.01	T	....	....	0 57
Glenwood	....	....	....	0.30	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0 37	0.32	0.13	....	....	....	....	....	....	....	....	....	....	1.12
Grand Meadow	....	....	....	1.76	0.10	....	....	....	0.15	....	....	....	....	0.22	....	....	....	0.58	....	0.20	0.07	0.12	....	....	....	....	....	0.25	....	....	....	3.45
Greenfield	....	....	....	0.42	0.09	....	T	T	....	T	....	....	....	0.04	....	....	....	0.59	0 02	0.23	0.06	T	....	T	T	....	T	T	....	....	....	1.45
Grinnell	....	....	....	1.35	0.15	....	....	....	....	....	....	....	....	0.50	....	....	....	0.85	T	0.32	T	T	....	....	....	....	....	0.30	....	....	....	3.47
Grundy Center	....	....	....	1.09	0.07	....	T	0.02	....	....	....	....	....	0.08	....	....	....	0.48	0.06	0.18	0.02	T	....	....	....	....	0.17	0.23	....	....	....	2.40
Hampton	....	....	....	0.71	0.25	0.06	0.04	....	T	....	....	....	....	....	....	....	0.15	0.05	....	0.33	....	0.05	....	....	....	....	0.56	....	....	....	....	2.23
Hopeville	....	....	....	1.12	0.08	....	....	....	....	....	....	....	....	T	....	....	....	0.33	....	0.29	....	T	....	....	....	....	....	T	....	....	....	1.82
Hopkinton	....	....	....	1.90	0.05	....	....	....	....	....	....	....	....	0.35	....	....	....	0.35	....	0.25	0.08	T	....	....	....	....	....	....	0.20	....	....	3.18
Humboldt	....	....	....	0.70	0.10	0.04	....	....	....	0.03	....	....	....	0.02	....	....	....	0 22	....	0.48	....	....	....	....	....	....	....	0.10	....	....	....	1.69
Independence	....	....	....	1 00	0.20	....	....	0 02	....	....	....	....	....	0.05	....	....	....	0.90	....	0.40	0.08	....	....	T	....	....	....	0.60	....	....	....	3.25
Indianola	....	....	....	0.70	0.27	....	0.01	....	T	....	....	....	....	T	....	....	....	T	T	....	0.01	....	....	....	....	....	T	T	....	....	T	0.99
Iowa City	....	....	....	0.40	0 20	0.04	....	....	....	....	....	....	....	0 51	....	....	....	0.62	....	....	....	....	....	....	....	....	....	0.26	....	....	....	2.03
Iowa Falls	....	....	....	0.73	0.15	....	T	....	....	....	....	....	....	0.30	....	....	....	0.26	T	0.19	0 07	T	....	....	....	....	0.15	0.10	....	....	....	1.55
Keokuk	....	....	....	0.30	1.34	0.17	0.21	....	....	....	....	....	....	....	0.30	....	....	0.02	....	0.17	....	....	....	....	....	....	....	0.01	....	....	....	2.52
Keosauqua	....	....	....	0.60	1.34	....	0.18	....	....	....	....	....	....	0.10	....	....	....	0.75	....	0 03	....	....	....	....	....	....	....	0.05	....	....	....	3.05
Knoxville	....	....	....	1.40	0.55	....	....	T	....	....	....	....	....	....	....	....	....	0.30	....	0.22	....	T	....	....	....	....	....	0.10	....	....	....	2.57
La Crosse (Wis)	....	....	....	0.82	0.28	T	T	....	T	....	0.06	....	T	T	0.07	T	....	0 26	0.01	0.23	0.02	0.06	T	T	T	....	....	0.08	....	....	....	1.89
Larrabee	....	....	....	0.39	....	....	....	....	T	0.11	....	....	T	....	....	....	....	0.34	....	T	....	0.07	....	T	....	....	0.23	....	....	....	....	1.14
Logan	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.40	....	....	....	....	....	....	....	....	....	....	....	....	....	0.40
Le Claire	....	....	....	0.61	0.42	....	....	....	....	....	....	....	....	0.48	....	....	....	0.41	0.09	0.01	....	....	....	....	....	....	0.14	0.11	....	....	....	2.27
Maxon	....	....	....	0.64	0.75	....	T	....	....	....	....	....	....	T	....	....	....	0.40	T	T	0.40	....	....	....	....	....	....	0.05	....	....	....	2.24
Mechanicsville	....	....	....	1.48	0.26	....	....	....	....	....	....	....	....	0.34	....	....	....	0.60	....	0.23	....	....	....	....	....	....	....	0.60	....	....	....	3.51
Monticello	....	....	....	0.55	0.67	0.08	....	....	0.07	....	....	0.39	....	....	....	....	0.46	....	0.17	0.05	T	....	....	....	....	....	0.40	....	....	....	3.84
Mt. Pleasant	....	....	....	0.30	1.15	0.10	0.05	....	....	....	....	....	....	0.05	....	....	....	0.44	....	0.20	....	....	....	....	....	....	....	0.05	....	....	....	2.24
Murray	....	....	....	....	T	....	....	....	....	....	....	....	....	T	T	....	0.08	0.06	0.08	....	0.04	T	....	....	....	....	T	T	....	....	....	0.26
Newton	....	....	....	0.94	0.04	....	....	....	....	....	....	....	....	0.38	....	....	....	0.27	....	0.20	0.18	....	....	....	....	....	....	0.20	....	....	....	2.21
North McGregor	....	....	....	1.50	0.03	....	....	....	0.06	....	....	....	....	0.25	....	....	....	0.13	....	....	0.34	0.01	T	....	....	T	....	0.01	T	....	....	2.33
Omaha (Neb.)	....	....	....	0.45	0.01	....	....	....	T	....	....	....	....	....	....	....	....	0.23	....	0.20	0.01	0.01	....	....	....	....	T	0 02	....	....	....	0.91
Osage	....	....	....	0.32	0.40	....	0.04	....	T	T	....	....	....	0.11	....	....	....	0.11	....	0.43	....	T	....	....	....	0.04	....	0.40	....	....	....	1.85
Oskaloosa	....	....	....	....	1.38	....	....	....	....	....	....	....	....	0.12	....	....	....	0.25	....	0.32	....	....	....	....	....	....	....	0.14	....	....	....	2.21
Ottumwa	....	....	....	1.10	....	....	....	....	....	....	....	....	T	0.20	....	....	0.80	....	0.20	....	....	T	....	....	....	....	0.03	0.03	....	....	....	2.36
Ovid	....	....	....	1.33	0.04	....	0.03	....	....	....	....	....	....	0.17	....	....	....	0.41	....	0.37	....	0.01	....	....	....	T	....	T	....	....	....	2.36
Panama	....	....	....	0.18	....	....	....	....	....	....	....	....	....	....	....	....	....	0.37	....	0.07	....	T	....	....	....	....	....	....	....	....	....	0.62
Richland	....	....	....	....	1.13	....	....	....	....	....	....	....	T	0.11	....	....	....	0.74	0 14	0.18	....	T	....	....	....	....	0.14	0.17	....	....	....	2.61
Rockwell City	....	....	....	1.10	0.15	....	....	....	....	....	....	....	....	....	....	....	....	0.20	....	0.70	....	0.20	....	....	....	....	....	....	....	....	....	1.35
Rock Rapids	....	....	....	0.30	....	....	....	....	0.30	....	....	....	....	....	....	....	....	T	....	T	0.34	....	....	T	....	....	....	0.30	....	....	....	1.24
Sac City	....	....	....	....	T	....	....	....	....	....	....	....	....	....	....	....	....	0.75	....	0.25	....	....	....	0.05	....	....	....	0.10	....	....	....	1.15
Seymour	....	....	....	0.13	0.30	....	0.09	....	....	....	....	....	....	....	....	....	....	0.20	T	T	....	....	T	....	....	....	....	T	....	....	....	0.72
Sibley	....	....	....	0.25	....	....	....	T	....	0.16	....	....	....	....	....	....	....	0.29	T	0.07	0.09	T	....	T	....	....	T	0.15	....	T	....	1.01
Sioux City	....	....	....	0.23	....	....	....	....	....	0.02	....	....	T	....	....	....	....	0 30	....	0.04	0.02	0.01	....	....	....	....	T	0 02	....	....	....	0.64
Spirit Lake	....	....	....	0.10	....	....	....	....	....	0.05	....	....	....	....	....	....	....	0.20	....	0.32	0.11	....	....	....	....	....	0.39	....	....	....	....	1.17
Tipton	....	....	....	1.14	0.42	....	....	....	....	....	....	....	....	0.68	....	....	....	0.48	T	0.29	....	T	....	....	....	T	....	0.37	....	....	....	3.38
Toledo	....	....	....	1.23	....	....	....	....	....	....	....	....	....	0.12	....	....	....	0.62	....	0.25	....	T	....	....	....	....	....	....	0.31	....	....	2.53
Vinton	....	....	....	1 18	0.10	....	....	....	0.05	....	....	....	....	0.20	....	....	....	0.27	....	0.13	0.08	....	....	....	....	T	....	0 40	....	....	....	2.41
Washington	....	....	....	0.45	0.75	0.45	....	....	....	....	....	....	....	0.50	....	....	....	....	0.70	0.70	0.40	....	....	....	....	....	....	0.60	....	....	....	2.97
Webster City	....	....	....	....	0.75	....	0.12	....	....	....	....	T	....	T	....	....	....	....	0.20	....	0.25	T	....	....	....	....	....	0.38	....	....	....	1.70
Williams	....	....	....	0.70	0.20	....	0.10	....	....	....	....	....	....	....	....	....	....	0.25	....	0.25	....	....	....	....	....	....	....	0.12	....	....	....	1.62
Winterset	....	....	....	0.60	0 27	....	....	....	....	....	....	....	....	1.20	....	....	....	0.33	T	0.36	....	T	....	....	....	T	....	T	....	....	....	2.76

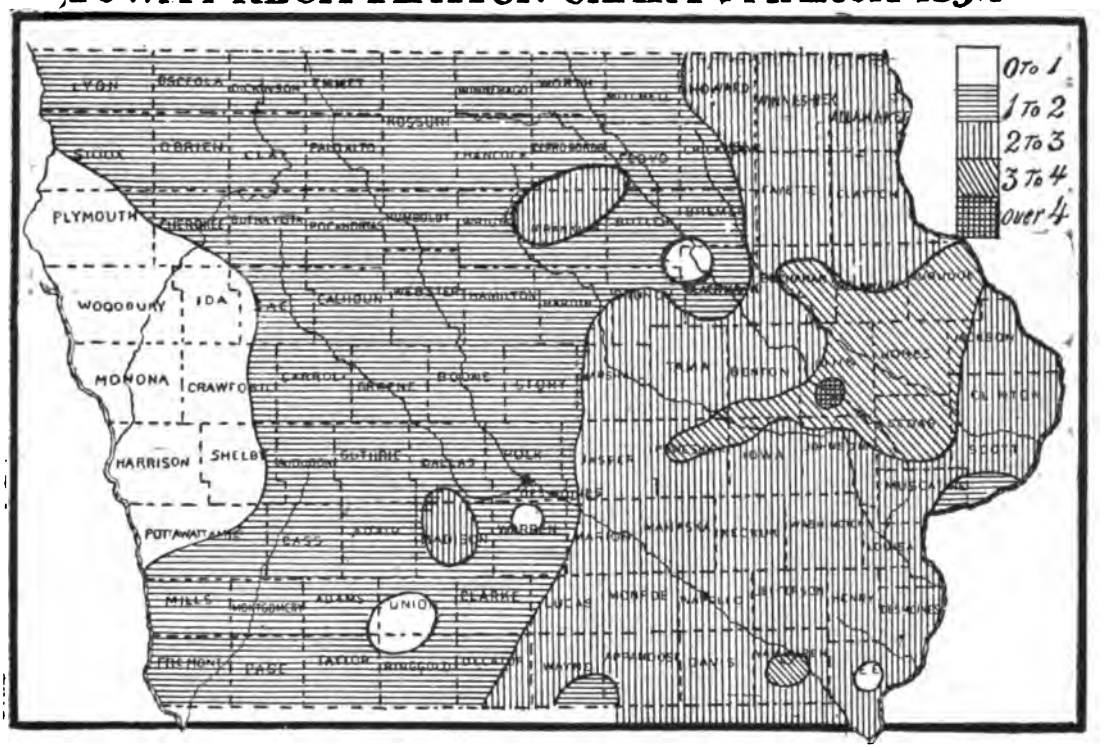
MAXIMUM AND MINIMUM TEMPERATURE FOR MARCH, 1894.

STATIONS.	1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		Mon'y Mean.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Alta	48	32	54	28	64	38	63	52	..	..	23	44	17	39	29	45	23	63	28	50	30	53	25	63	30	51	36	48	30	53	31	71	33	82	51	38	34	46	32	46	40	63	40	33	21	48	14	24	11	17	-4	24	-1	41	9	26	14	47	6	70	33	46	34	48.4	26.5
Amana	54	32	49	26	64	40	63	49	57	34	39	25	45	30	45	20	58	33	72	41	53	31	59	35	51	36	52	28	53	35	64	31	78	51	58	46	50	41	58	42	51	58	45	34	49	29	32	17	19	4	27	8	39	9	33	22	37	7	58	29	57	39	51.3	30.9
Atlantic	58	28	58	25	69	45	62	51	52	27	48	20	47	25	52	23	69	24	67	34	60	25	69	27	60	32	60	36	56	30	75	28	84	54	69	40	60	38	51	45	74	45	47	23	55	21	42	14	23	5	32	4	42	6	39	19	48	7	70	31	59	31	56.7	27.5
Audubon	52	34	54	25	67	44	61	52	55	27	43	20	42	29	49	25	65	29	63	35	55	27	71	33	54	39	57	30	53	28	71	34	81	53	70	55	53	37	49	43	71	46	46	21	51	20	38	15	18	2	26	1	41	8	38	18	46	8	69	31	54	34	53.6	28.6
Belle Plaine	56	32	52	25	66	37	64	48	58	30	38	24	43	36	41	31	59	31	73	39	54	29	60	34	51	32	54	27	54	33	65	36	78	50	60	44	51	40	57	41	73	50	44	32	50	29	31	14	19	3	28	6	40	8	32	18	39	5	60	27	57	36	51.8	29.5
Bonaparte	57	30	54	29	69	39	67	48	55	40	43	26	46	32	47	22	64	31	75	39	57	31	61	33	57	40	56	29	56	38	67	32	80	49	79	50	58	44	73	47	78	54	64	33	50	31	41	26	25	7	36	9	45	11	37	21	41	11	61	24	60	42	56.9	32.2
Carroll	55	27	62	36	68	38	56	34	32	26	42	18	43	30	44	22	64	26	58	30	66	28	66	34	52	40	54	26	56	28	71	35	82	46	52	38	52	38	48	36	71	41	34	20	50	18	21	12	21	0	19	1	40	8	25	16	42	6	58	32	52	32	50.5	26.5
Cedar Falls	56	32	51	23	65	36	56	45	50	31	46	22	40	30	45	22	58	32	70	38	54	29	62	29	52	37	51	24	52	31	65	27	80	49	56	44	47	39	50	40	74	40	36	31	49	27	30	15	22	2	30	5	59	29	49	39	50	3	59	29	49	39	50.3	28.6
Cedar Rapids	54	34	50	32	64	42	61	50	52	48	40	24	36	33	46	25	56	37	72	45	52	33	57	37	56	45	52	32	53	34	62	35	75	53	57	54	52	48	56	45	72	54	42	35	48	32	32	24	32	6	27	10	36	18	33	29	36	10	56	32	56	36	50.4	34.6
Centerville	60	20	59	18	59	17	62	16	64	29	66	35	65	37	69	39	66	33	70	37	71	36	69	35	70	36	68	38	72	38	72	36	71	38	66	37	68	37	70	39	71	38	75	43	75	44	38	32	34	32	34	4	36	3	40	15	45	21	51	24	60	30	61	2	30.2
Charles City	50	34	50	25	65	40	60	50	35	24	35	20	38	32	42	20	57	32	60	40	50	28	58	32	40	34	45	31	50	32	64	32	78	40	44	36	45	38	45	40	55	44	33	31	45	25	24	15	18	-1	21	1	36	7	26	20	36	0	52	32	45	38	45.2	28.1
Clarinda	52	30	54	30	66	43	62	52	53	25	45	22	42	29	50	26	67	30	67	34	56	30	67	36	57	40	58	34	54	35	71	35	81	54	64	41	52	40	51	50	71	37	38	24	52	24	29	11	19	5	28	5	44	12	40	19	46	13	64	30	59	36	53.5	30.1
Clinton	52	31	52	24	65	36	64	46	55	47	46	28	47	29	45	22	57	35	73	44	53	32	56	29	54	34	50	28	53	34	65	29	80	49	69	50	52	42	59	41	75	52	64	39	50	30	41	20	33	8	30	9	39	11	39	27	36	3	58	26	58	38	53.7	31.4
College Springs	54	32	52	30	66	43	63	51	53	21	41	22	45	26	50	25	69	33	67	32	57	28	71	36	59	35	56	32	57	31	74	36	83	53	71	41	52	39	54	42	72	48	44	22	56	20	32	19	28	5	30	0	45	13	41	18	48	16	67	30	60	42	55.7	29.7
Corning	57	32	55	29	68	48	63	51	55	30	45	21	45	34	51	26	67	29	69	37	57	28	66	35	60	40	57	30	55	31	72	36	82	54	61	41	52	39	54	46	73	50	51	23	53	24	45	19	24	5	30	4	41	12	39	19	45	12	66	33	61	41	55.4	30.9
Cresco	47	31	48	24	62	38	56	46	38	28	36	20	37	25	40	19	50	29	63	34	46	28	55	30	47	31	44	26	46	31	62	27	76	47	61	38	40	36	43	35	64	42	44	28	42	24	26	9	18	2	27	5	37	6	27	15	31	1	51	16	46	32	45.5	25.9
Davenport	54	31	52	34	65	43	64	47	55	52	42	27	47	32	45	27	59	36	74	48	53	34	57	39	52	43	50	32	52	39	63	37	78	54	64	52	51	44	70	41	76	54	45	38	47	29	32	24	19	6	25	10	35	17	35	27	37	12	57	31	56	43	52	0	34.8
Decorah	50	32	52	24	64	38	59	38	50	32	38	21	36	29	43	19	52	33	66	38	49	30	55	29	49	36	46	24	46	34	63	23	77	39	57	44	43	37	43	36	66	44	51	39	43	25	23	10	23	3	21	7	37	8	33	7	35	7	52	27	45	37	47.3	27.4
Des Moines	58	33	55	30	68	46	63	52	43	32	42	22	44	34	49	26	67	33	69	41	56	32	66	38	53	45	56	31	54	36	70	39	81	56	56	44	52	42	59	43	74	52	38	25	51	28	30	19	19	4	29	6	38	13	29	21	44	12	65	33	56	44	52.7	32.6
Dubuque	53	32	52	26	66	40	60	49	58	43	42	25	48	29	45	25	55	35	73	47	52	32	58	34	50	42	46	30	49	39	65	32	78	51	63	49	46	40	50	39	74	46	46	38	46	28	31	22	18	7	26	10	35	14	36	26	33	12	56	22	54	40	50	4	32.3
Elkader	56	32	54	32	66	39	58	49	56	31	43	23	40	27	47	19	57	31	71	41	53	30	62	28	51	32	48	24	51	33	65	26	80	52	61	45	45	30	48	38	75	45	43	32	47	27	30	14	20	5	29	8	37	9	37	20	37	3	54	25	58	35	50.7	28.4
Galva	49	31	55	27	65	39	62	52	55	24	43	19	40	30	43	22	44	28	49	35	55	25	65	25	51	37	50	29	53	32	71	30	82	50	72	34	46	34	47	41	67	42	53	32	43	17	41	13	17	-2	26	0	40	16	31	8	48	28	72	34	65	33	51.6	27.5
Glenwood	64	34	62	32	72	50	66	54	55	28	46	21	58	32	54	30	80	34	72	37	64	30	72	38	82	44	60	34	60	33	..	..	86	40	70	40	56	40	64	48	80	40	50	24	68	20	48	14	32	-4	44	-4	54	14	46	16	50	12	89	48	63	42	62.0	30.7
Greenfield	55	30	58	30	69	44	65	51	55	28	47	22	45	29	54	24	67	30	67	35	57	28	65	33	58	38	61	27	57	30	73	36	83	54	69	40	55	39	52	44	75	50	50	22	54	22	43	14	23	3	32	1	44	12	38	18	47	7	68	30	59	37	56	3	29.3
Grinnell	54	32	51	32	66	40	62	50	58	31	38	22	37	32	45	32	60	34	70	48	53	36	58	38	50	38	58	32	57	36	69	38	78	50	69	46	50	37	55	40	77	52	65	32	47	30	46	19	16	5	25	7	36	16	37	22	40	11	60	32	57	40	53.0	32.6
Grundy Center	51	26	51	30	66	40	63	44	45	22	39	22	40	23	45	25	59	31	69	29	53	30	61	33	48	27	50	32	53	30	67	34	78	52	56	38	47	38	53	40	71	30	39	25	48	27	29	0	20	2	28	5	40	13	30	19	4	4	0	61	32	55	25	50	2	26.0
Hampton	52	32	51	26	65	35	58	49	34	25	37	20	40	27	43	20	58	28	67	36	53	30	61	32	52	27	62	32	45	29	49	26	51	30	67	27	79	52	44	39	44	34	51	39	70	45	36	28	48	22	25	8	18	-1	26	3	38	6	37	15	40	3	61	30	51	31	48.4	26.5
Hopeville	55	32	51	31	67	40	62	50	54	30	44	23	42	32	48	26	65	32	67	37	56	30	65	35	56	40	56	30	54	33	70	35	80	54	68	41	53	40	55	46	72	52	52	25	51	29	39	18	20	5	28	4	39	13	37	21	44	10	63	30	59	38	54.0	31.0
Indianola	56	32	54	29	68	44	65	50	59	31	42	22	42	31	48	25	65	33	72	41	67	35	66	32	66	44	66	30	56	35	70	39	81	55	73	43	52	40	43	37	75	53	75	27	52	29	49	19	27	4	38	6	39	12	24	20	45	15	67	31	58	42	57.1	31.8
Independence	54	31	51	26	64	34	62	45	56	35	40	22	38	27	44	23	57	31	70	45	62	33	58	32	57	40	47	27	51	48	64	29	78	48	63	46	47	38	49	39	75	45	46	34	46	26	32	19	20	3	27	6	35	9	34	26	33	4	56	26	54	41	50	6	30.3
Iowa City	56	31	53	25	66	37	67	46	59	43	43	26	50	31	48	21	62	33	76	42	57	31	61	31	55	39	52	30	55	35	57	29	81	49	72	50	52	44	61	41	75	53	70	35	57	30	38	19	20	5	29	9	40	13	37	30	38	10	60	28	60	42	55.6	31.9
Iowa Falls	52	31	50	24	63	35	56	47	53	24	39	18	38	25	42	20	56	28	64	33	52	26	61	30	54	27	48	24	52	30	65	28	78	49	62	38	45	35	47	37	70	45	59	26	46	22	39	6	15	-3	26	0	36	5	27	8	40	1	61	28	51	31	49.9	25.1
Keokuk	56	32	56	33	70	41	69	49	58	48	44	28	45	35	48	27	66	39	78	49	55	33	63	40	58	48	55	33	56	43	66	38	79	54	65	57	60	45	74	49	79	58	45	38	50	32	35	28	29	8	26	10	40	17	44	26	44	15	67	33	60	46	56.2	36.1
Keosauqua	60	31	53	26	68	41	65	49	59	40	58	37	45	35	51	24	66	30	76	43	58	33	64	37	58	41	55	29	57	39	66	35	84	53	65	52	58	44	71	49	78	53	72	34	54	32	40	20	24	9	29	10	40	15	37	28	44	13	62	30	62	42	57.4	34.0
Knoxville	57	32	51	28	67	44	66	49	49	32	41	23	41	30	48	24	63	31	72	43	56	31	58	37	60	43	55	27	52	44	69	36	80	54	55	44	51	40	61	43	76	54	41	27	51	29	30	20	20	4	26	5	38	12	28	20	42	9	62	30	58	43	52.4	31.5
La Crosse (Wis.)	54	33	53	29	66	40	57	48	56	32	38	22	39	30	43	23	51	34	67	44	67	31	58	32	46	39	44	27	46	33	64	29	78	51	62	42	42	36	45	35	52	42	44	33	46	26	24	10	16	6	25	9	36	13	37	25	36	15	55	29	50	35	48	0	30.0
Larrabee	47	32	56	28	66	38	64	30	32	22	44	17	39	26	45	22	..	..	57	32	54	25	64	31	51	34	51	32	54	32	71	31	82	50	62	31	45	29	45	40	53	38	38	22	39	16	38	10	20	-5	26	0	40	9	33	13	50	5	72	34	53	31	49	7	25.1
Logan	50	30	57	27	67	45	70	53	50	26	42	18	46	22	43	24	70	23	60	29	60	25	70	30	64	40	62	24	57	27	75	37	85	55	41	39	55	37	51	41	72	40	48	22	47	17	19	17	17	3	26	3	42	8	26	15	52	9	73	29	72	40	54.0	27.9
Mechanicsville	18	30	47	27	62	36	63	44	55	48	38	24	45	29	43	22	55	32	75	42	52	30	57	32	49	40	49	27	51	23	62	30	76	48	59	45	49	43	56	38	74	53	49	36	47	26	31	21	19	4	25	8	37	12	32	26	34	7	56	26	56	38	50.0	30.5
Newton	57	33	52	26	67	40	62	48	58	29	40	20	41	29	47	21	64	31	70	40	56	29	63	35	56	35	55	27	53	33	69	31	79	50	65	41	51	39	58	41	74	51	66	28	51	28	43	14	19	2	29	3	39	9	38	18	44	6	65	30	57	41	54.5	27.3
Omaha (Neb.)	57	35	61	36	71	47	64	55	35	26	46	24	44	30	52	30	70	33	62	40	57	32	70	37	57	36	59	36	56	35	76	42	84	56	44	41	55	38	54	47	71	48	36	23	56	21	28	18	30	4	28	5	44	18	30	16	50	14	70	37	55	43	53.6	32.4
Ovid	60	30	56	27	68	43	67	49	53	31	45	22	43	30	50	24	65	32	74	48	59	29	66	36	63	36	58	29	55	34	69	36	80	54	57	43	56	41	63	46	76	56	43	26	52	30	37	17	25	5	32	5	40	12	30	19	44	9	63	31	61	41	55.2	31.3
Oskaloosa	58	32	55	25	69	40	69	50	52	32	44	25	45	31	49	22	66	32	73	40	57	31	63	36	55	38	58	29	55	36	69	34	80	51	64	45	54	41	61	44	76	51	63	30	52	31	31	17	20	6	30	7	41	11	30	19	42	10	64	31	60	43	55.0	31.2
Ottumwa	60	32	58	28	70	42	70	49	59	35	43	26	47	33	48	23	66	35	75	42	56	33	63	39	57	40	57	33	59	39	68	38	81	53	66	47	58	43	66	42	78	55	67	32	51	32	42	18	20	6	27	8	38	14	35	23	42	13	62	32	60	43	56.4	33.1
Panama	52	32	56	30	67	43	61	52	54	26	48	21	40	28	49	27	67	29	61	34	57	26	68	31	57	40	58	31	55	33	73	36	82	54	71	36	53	41	73	51	78	53	68	33	51	33	41	23	15	18	2	26	3	40	12	24	20	45	15	67	33	60	46	54.7	29.5
Rock Rapids	38	16	46	24	54	38	53	40	..	..	38	17	44	25	46	24	64	26	50	33	52	26	58	34	63	36	60	32	68	32	73	38	80	40	58	36	44	34	40	40	40	32	38	24	38	22	44	20	20	5	28	-2	14	10	20	14	43	5	73	21	45	29	48.1	25.4
Sac City	46	30	48	31	47	32	47	33	42	34	44	32	47	33	46	30	46	32	44	28	52	26	63	33	51	35	60	33	52	34	72	38	82	52	44	33	62	33	48	42	52	40	47	35	35	20	20	18	15	-2	25	1	36	21	26	15	43	15	47	31	50	22	46	4	28.6
Seymour	57	31	58	30	69	44	68	50	60	35	45	23	45	32	48	26	63	33	72	42	55	31	65	35	63	40	56	28	54	34	70	36	80	55	67	48	55	42	65	48	76	52	72	28	50	30	48	24	30	5	27	6	40	12	38	23	43	11	60	30	60	41	56.7	32.3
Sibley	45	29	51	26	60	35	64	47	40	20	43	15	37	27	45	20	61	24	55	32	50	23	61	29	54	33	53	29	51	31	69	30	80	45	70	32	43	29	44	38	44	37	43	24	45	15	38	10	16	-5	24	-2	43	6	34	12	48	2	72	31	65	34	49.9	24.5
Sioux City	51	33	56	33	67	40	65	34	31	20	45	21	41	26	50	27	70	30	53	34	58	28	70	32	53	40	55	35	57	37	72	39	82	52	48	34	48	33	49	43	67	41	33	24	53	19	24	11	19	0	27	2	42	16	26	14	51	12	74	36	48	36	51.1	29.1
Spirit Lake	40	18	52	28	63	35	65	50	50	19	45	15	45	35	45	15	63	43	60	36	54	20	63	32	53	21	53	29	60	33	63	35	82	45	66	33	53	43	43	37	45	37	42	26	43	16	40	5	16	-5	30	0	41	6	33	6	45	33	63	37	55	33	50.7	25.5
Toledo	56	32	50	25	66	40	63	48	50	33	40	25	42	31	45	20	53	30	72	46	50	29	60	36	50	40	56	30	52	30	65	30	82	50	68	50	46	44	54	42	78	54	54	32	38	32	30	18	20	2	25	5	47	5	30	20	40	4	62	31	46	42	51.0	30.8
Tipton	53	31	52	29	65	39	65	46	57	39	42	25	49	29	46	23	60	34	73	31	55	35	60	35	52	36	52	30	53	35	64	32	79	52	65	48	50	42	57	40	74	52	62	36	50	27	49	16	20	5	28	10	39	13	34	22	38	8	60	30	56	38	53.5	31.2
Winterset	58	34	56	28	68	43	63	50	38	31	48	22	43	32	49	25	67	32	69	40	57	30	66	37	57	42	58	29	53	33	70	37	81	49	50	42	51	39	53	43	75	51	40	24	52	26	32	19	20	3	28	4	41	11	30	20	46	11	66	30	58	41	53.0	30.9

MEAN TEMPERATURE MARCH 1894



IOWA PRECIPITATION CHART. MARCH 1894



METEOROLOGICAL STATIONS AND OBSERVERS.

From the following, weekly and monthly reports of Meteorological data are received by the Iowa Weather and Crop Service.

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Albia (Maxon)	Gus Johnson.
Algona	C. D. Pettibone.
Alta	D. E. Hadden.
Amana	Conrad Schadt.
Ames (Exp. Station)	W. H. Helleman.
Ames	Fred L. Kent.
Atlantic	J. W. Love.
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Belle Plaine	H. W. Vandike.
Blakeville	James Rodgers.
Bonaparte	Hon. B. R. Vale.
Carroll	Moses Simon.
Cedar Falls	Prof. A. O. Page.
Cedar Rapids	H. D. Olds.
Centerville	Prof. H. E. Reister.
Charles City	J. W. Smith.
Clarinda	A. S. Van Sandt.
Clinton	Luke Roberts.
College Springs	A. A. Berry.
Corning	John W. Bixby.
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Greenfield	J. G. Culver.
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Hampton	E. C. Grenelle.
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Hopkinton	Theo. Marks
Humboldt	H. S. Wells.
Independence	E. F. Wulfke.
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Iowa City	Prof. A. L. Arner.
Iowa Falls	J. B. Parmelee.
Jefferson	Dr. Chas. Enfield.
Keokuk	*Fred. Z. Gosewisch.
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Knoxville	Casey and Reeves.
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Omaha, Neb	*Geo. E. Hunt.
Ovid	H. C. Miller.
Osage	G. D. Pattingill.
Oskaloosa	Jos. Boyd.
Ottumwa	L. J. Baker
Panama	Wm. J. Wicks.
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Rock Rapids	W. C. Wyckoff.
Rockwell City	G. B. Rigg.
Seymour	Mrs. C. A. Conger.
Sibley	H. G. Doolittle.
Sidney	G. V. Swearingen.
Sioux City	*U. G. Pursell.
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Spirit Lake	W. C. Drummond.
Tipton	J. M. Rider.
Toledo	Chas. Mason.
Vinton	T. F. McCune.
Villisca	Paul Welch.
Washington	Wm. A. Cook.
Webster City	C. M. Trumbauer.
Winterset	Will McKnight.
West Bend	Phil. Dorweiler.
Williams	M. L. Fuller.

*U. S. Weather Bureau.

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Winterset	H A. Kinsman.
Wall Lake	F. E. Wilcox.
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What Cheer	O. D. Lawrence.

Met. 217

UNITED STATES DEPARTMENT OF AGRICULTURE
WEATHER BUREAU.

MONTHLY REVIEW

OF THE

HARVARD COLLEGE
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Iowa Weather and Crop Service.

VOL. V. —APRIL, 1894.—NO. 4.

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DIRECTOR.

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LOCAL FORECAST OFFICIAL,
U. S. WEATHER BUREAU, ASS'T DIRECTOR.

DES MOINES:
G. H. RAGSDALE, STATE PRINTER.
1894.

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U. S. Department of Agriculture---Weather Bureau.

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MONTHLY REVIEW

OF THE

IOWA WEATHER AND CROP SERVICE.

VOL. V.] APRIL, 1894. [No. 4.

EDITORIAL NOTES.

Corn and clover are the prime factors of the farmer's prosperity.

***

The clover-cure affords the surest and cheapest remedy for the ill effects of soil-robbing.

***

The propositions of the "rain-makers," when analyzed, are really a bet on the weather, in which only one side puts up any money. If it rains the "rain-makers" win, but if it does not rain they don't lose.—*Sioux City Journal.*

***

Iowa heads the list of states in the value of live stock, in the number of milch cows, and in the number of head of swine. This State has nearly twice as much money in stock as Texas.

***

Hon. John G. Smith, of Algona, Iowa, writes under date of April 19th as follows: "I notice on page 7 of your March REVIEW you state that Brant were seen throughout the State early in March. I think that must have been a mistake, as Brant are seldom found 100 miles from the sea shore. The reporters might have seen White Pointed, Snow or Hutchins geese. I have never known of any Brant in Iowa but once in twenty-eight years, and I am familiar with that class of birds."

***

In regard to the two shoals or patches of green water discovered in the Gulf of Mexico, one ten miles from the mouth of the Mississippi, fifty-four feet deep, where the surrounding water is 600 to 900 feet, and the other in 27 degrees south latitude, 88 degrees, 28 minutes west, some twenty-five miles from the mouth of the Mississippi. Several sea captains in the Central American trade declare that they are bodies of fresh water boiling up from the bottom of the sea. A captain long engaged in the Central American trade declares that it is possible to secure fresh water in the gulf far out at sea. The source of the green or fresh water spots is supposed to be the Rocky mountains and the enormous submarine rivers flowing under Texas, which have been tapped at so many points by artesian wells, returning a bountiful flow of water.

***

The aerolite which fell lately near Oxford Junction, has been dug out and proves to be about ten inches in diameter and round in form; a fracture shows a bronze color, and it is very heavy. This piece is evidently a fragment of the great body that came swiftly to earth a short time ago, illuminating the earth, and scaring timid souls into hysterics, and frightening old persons of both sexes with the dread of universal destruction.—*Iowa City Press.*

***

The internal temperature of trees has been investigated in Belgium by M. W. Prinz, who finds that, as a rule, a large tree is warmer than the air in winter, and a little colder than the air in summer. The mean annual temperature of a tree is practically the same as that of the surrounding air, but the monthly means differ by several degrees. Heat changes are transmitted slowly to the heart of the tree, the temperature of the interior differing sometimes as much as 10 degrees centigrade from that of the air. When the air temperature is below freezing point, the temperature of the tree appears to remain just above the freezing point of its sap, and in the hot days of summer the internal temperature was not known to vary more than 2 degrees from 15 degrees centigrade (59 degrees Fahrenheit).

***

The London *Hospital*, a medical journal of high authority, says: "There are two sorts of pressure which tend to shorten life; blood pressure within and atmospheric pressure without. The latter is a specially important factor in a humid climate. In advancing age the circulation of the blood and lymph tends to become slow, and the enfeebled heart finds its embarassments increased by this condition. Especially do the more vascular organs, such as the lungs, the liver and the kidneys, put skids on

the wheels of the blood circulation. Plainly, then, an important condition of cardiac easement, and therefore of life prolongation, is the maintenance of an uncongested state of lung, liver and kidney. Thus are internal pressures relieved, and thus is cardiac energy conserved. Of almost equal importance, at any rate in Great Britain, is the question of atmospheric pressure and moisture to aged persons. Situations which are at once low-lying and damp give, of course, a maximum of atmospheric pressure. Such pressure weighs down at a single stroke body, mind and life. The difference to aged persons between living at the sea level and living 500 feet above it, between living in a moist atmosphere and living in a dry one, is sometimes incalculable. Not seldom life may be lengthened by five or even ten years by living in an atmosphere which is both light and dry. These physiological considerations are commended to the aged, and to the physicians of the aged."

***

Writing on "Electricity and Life" in the *Humanitarian*, H. Newman Lawrence comes to the following conclusions: (1.) All the thousand and one changes which take place in the structure of the living body, be they due to the never-ceasing and involuntary progress of metabolism, or to the exercise of function, or to the effort of will, partake of the nature of chemical change. (2.) All chemical changes are accompanied by electrical manifestations. (3) Without chemical change and interchange, life does not appear to exist. (4.) Therefore, life is always accompanied by the generation of electricity. Electrical energy, however, is not the immediate source of the vitality of the body.

***

The difference between hail and sleet is explained by the Bulletin of the New England Weather Service as follows: True hail is usually composed of alternate concentric layers of hard, transparent and soft opaque ice. In this latitude it seldom falls except in summer or the latter part of spring. It may fall during any time of day or night, but is most apt to fall and in larger size during the hottest part of the day. It is usually accompanied by thunder and lightning, and is formed in the upper air. Sleet, on the contrary, falls during the winter and is composed of small particles of transparent ice. Rain from a warmer upper wind is frozen in its passage through a strata of air. Often sleet with rain that has not quite reached the freezing point falls together. If it is very cold and the sleet and rain freezes to the object which it strikes it is called an ice-storm.

***

Hon. H. C. Wheeler, of Odebolt, Sac county, is reported to have planted this year 3,500 acres of corn. He says corn is the crop in his section, with clover to enrich the soil.

***

The fact that the Periodical Cicada, or so-called "17-year Locust," is to appear in two great broods the present season is stated by a number of newspapers to have been announced by the U. S. Department of Agriculture, and these statements have caused some unnecessary alarm among those who do not understand the exact nature of the insect, or who confound it with true locusts or so-called "grasshoppers," owing to the somewhat careless newspaper wording. The department has made no such public announcement the present year, although the Cicada chronology published by Professor Riley in Bulletin No. 8 of the division of entomology in 1886 predicted an extended appearance of the insects in 1894. The entomologist of the department has been interviewed on the subject, and states that the damage done by these insects is, as a rule, quite immaterial, consisting in the slight cutting, breaking, and deadening of the terminal twigs of fruit and shade trees by the females in the act of laying their eggs. The injury becomes serious only when the insects are exceptionally abundant and oviposit in young nursery stock. The larvæ, which live underground and feed to some extent upon the roots of plants, gradually rise to the surface of the ground when nearing full growth, and from about May 20 to June 1 they begin to make their appearance above ground in the nymph or pupa condition. They crawl up the trunks of trees, cast their skins, and the winged insect comes forth. The adults are prevalent for five or six weeks, and, as above stated, do some little damage to trees and shrubbery by puncturing them for the purpose of egg-laying. The eggs hatch in about two weeks and the young larvæ drop to the ground, which they enter to begin their long subterranean life.

***

It will be a surprise to many of the people of Portland to learn that the average annual rainfall in the vicinity of Neah bay, Washington, is about one hundred inches. It will be an equal surprise that the average annual precipitation at Pasco, in Washington, a little more than two hundred miles north of Neah bay, does not exceed ten inches. The heavy rainfall of the states of Oregon and Washington occurs only at the points immediately on the coast. Astoria gets 79.45 inches of rain a year, while at Portland, a little more than one hundred miles inland, the annual precipitation is only 49.34 inches. The annual precipitation at Portland is but three inches in excess of the annual precipitation at Boston, and less than four inches more than the annual rainfall at New York, while it is less by nearly thirteen inches than the amount of rain that falls every year at New Orleans. At Ashland, in southern Oregon, only twenty-two inches of rain falls a year.—*Portland Oregonian.*

***

Tiled land is dryer in a wet season, and moister in a drouth, than undrained land. In other words, well drained soil best endures the extremes to which this region is subjected.

***

Mr. F. E. Ormsby, who terms himself an "occult astronomer," goes far beyond our planetary meteorologists in ascribing great potentiality to the planets in controlling the affairs and conditions of human life on our little earth. They shape and determine the characters and destinies of men, as well as the weather. What you are was predestined by the planet under which you were

born. In a recent article Mr. Ormsby described two male children, born in the same town only a few weeks apart, reared and educated in the same school, and at the age of twenty engaged in the same work. One becomes a millionaire, a leader and director in the commercial world, and the other drifts from one thing to another and finally becomes a pauper. What is the secret cause? Mr. Ormsby says: "Without hesitation I declare it to be magnetic forces, qualities, and co-ordinations with the universal magnets of our solar system." The millionaire was born under Jupiter's dominance, and the pauper chanced to come under the sway of a minor star! The present position of the planet, according to his theory gives the following:

"Mercury has passed into Pisces in strong aspect to Jupiter and Neptune, which will intensify the business world to quite an extent, and Jupiter and Neptune people will receive an impulse to take action in business matters. As many will receive this vibration about the same time, a general effect will be noticed. Business generally is under Jupiter, but Neptune influences railroad stocks and bonds largely, and the influence of Mercury will tend to change the rates and quotations of such collaterals. Venus has crossed the line of the Apsides and is now in conjunction with Mars, and in quadrature to Saturn, all three polarized to the brain of man. Venus, therefore, will soften the harsh and combative tendencies produced by Mars and Saturn, and tenderness and sympathy will be characteristic of the utterances of the people. Peaceable times are indicated by the stars just at present, and no serious battles can be entered into under this magnetic combination. Business should improve under this favorable wave, for confidence will be restored, and many strikes settled peaceably and satisfactorily."

Somehow the above paragraph reminds us of one of Prof. Foster's dissertations on the weather as affected by planetary conjunctions, magnetic currents and things. And it is just about as reliable.

***

An explanatory note from the venerable Theodore Marks, of Hopkinton, Iowa, contains the following: "For the first time in fifty-five years' recording the weather, I have lost a day in April, 1894; cause, second childhood." This is a most notable record, and many years after Mr. Marks has passed the way of all the earth his weather tables will be studied and used as a basis of comparison by meteorological experts. They possess a local value beyond computation, and the faithful work of this painstaking observer will be appreciated by generations to come. Mr. Marks was a sailor in his boyhood days, and his letter contained an ancient commercial paper, Canton (China) *General Price Current*, dated April 26, 1836, filled with interesting matter.

***

The Iowa State Fair begins Friday, August 31st, to hold eight days. It promises to be one of the finest exhibits ever made by the Society, with some new and attractive features.

LIVE STOCK STATISTICS.

The Washington representative of the Chicago *Record* compiled the following statistics:

Iowa stands at the head of the list of states in the value of her live stock, which is $206,465,242: Illinois comes second with $180,431,662; Missouri, $138,701,178; Kansas, $128,068,305; New York, $124,523,965; Ohio, $116,181,690; Texas, $103,259,503. It is a curious fact that Iowa has almost twice as much money in live stock as Texas.

Illinois owns more horses than any other state in the Union, the number being 1,335,281. Iowa comes a close second with 1,312,079; then Texas, 1,026,002; Missouri, 946,401; Kansas, 930,305, and Ohio, 880,677.

Texas is the greatest cattle state of the Union, the number of oxen, cows and beef cattle reported by the census being 6,201,552; then Iowa, 4,895,550; Kansas, 3,188,033; Illinois, 3,062,119; Missouri, 2,969,716; Nebraska, 2,142,597; New York, 2,131,392. For milch cows Iowa heads the list with 1,498,418; New York second, with 1,440,230; Illinois third, 1,087,883; then Texas, 1,003,439; Pennsylvania, 927,254; and Missouri, 851,076.

The Southern states are short on milch cows and long on oxen. Texas heads the list for the largest number of oxen, having 98,284; Alabama is second, 97,300; Mississippi third, 95,577, and then come Kentucky, Arkansas and Tennessee in order.

Although Iowa has the largest number of cows, New York produces the most milk and heads the list with 663,917,240 gallons annually. Iowa is second with 480,961,411; Pennsylvania, 368,906,480; Illinois, 367,269,464; Ohio, 426,925,376, and Wisconsin, 303,701,134 gallons. New York also leads the list of the butter-makers of the Union, producing 98,241,813 pounds. Pennsylvania is second, 76,809,041; Ohio, 74,990,307; Iowa, 77,893,079; Illinois, 57,021,486; Indiana, 48,477,766; Wisconsin, 46,295,623; Kansas, 46,017,076.

New York is the largest cheese state also, producing 4,324,928 pounds. California comes second, with 3,071,525; then Ohio, with 1,068,082; Iowa, 1,038,358; Wisconsin, 906,266, and Kansas, 759,210.

The following is a very interesting table, showing the dairy products in all the states that stand in the first rank in that industry. It furnishes an interesting comparison:

STATES.	Number milch cows.	Milk—gallons.	Butter—pounds.	Cheese—pounds.
Iowa	1,498,418	486,961,411	77,893,079	1,038,358
New York	1,440,230	663,917,240	98,241,813	4,324,028
Illinois	1,087,866	367,296,464	57,021,486	343,456
Texas	1,003,439	118,475,320	32,100,560	145,730
Pennsylvania	927,254	368,906,480	16,809,041	439,060
Missouri	851,876	193,931,103	43,108,521	288,620
Ohio	794,833	326,925,396	74,999,307	1,068,083
Wisconsin	792,620	303,701,134	46,295,623	906,266
Indiana	579,287	200,510,797	48,477,766	367,948
Kansas	741,786	201,608,099	46,017,079	759,210
California	317,101	111,191,186	26,766,704	3,871,575

The greatest hog state in the union is Iowa, where the census agents counted 8,266,779 swine. Illinois is next with 5,925,818; Missouri, 4,997,432; Kansas, 4,022,933; Nebraska, 3,815,647; Indiana, 3,320,817, and Ohio, 3,275,922.

METEOROLOGICAL CONDITIONS AND PUBLIC HEALTH.

BY DE LORME W. ROBINSON, M. D , PIERRE, SOUTH DAKOTA.

In no other portion of the world are so many and so rapid changes of temperature as occur in the part of the world in which we live, and in no other portion are these variations so marked and frequent as in the Northwest states. During the colder seasons of the year these phenomena of high and low temperature and warm and cold areas occur on an average of once in from seven to ten days, and traverse along one or more extensive storm-paths, on which they are constantly recurring.

These extreme variations from a high to a low temperature meteorologically are known as "cold waves." So far as known they originate in the far north, and extend in three general directions over large areas of the United States. First, over a long sweep of plains east of the Rockies from Manitoba to the Gulf. Second, a west to east translation from the North Rockies across the great lakes to the Atlantic. Third, from the Red river region south through the valley of the Mississippi and over the Middle states.

Evidence so far gathered, chiefly through meteorological observation, have led investigators to believe that these cold waves are the result of radiation from barren and snow-covered surfaces, principally in the Arctic north.

The warmer or higher temperature areas which so often bring soft and pleasant winter weather to the more humid portions of the Northwest states, and to the dryer regions of these states the balm of May in January, pass eastward or southward, and in their wake, and often under-running them, comes a rush of cold wave, dry air, made colder by the pulsations and interminglings of the upper and colder air currents.

When the atmospheric pressure is great and the earth's surface unbroken by mountains and hills, these in-rushes of cold are violent, the friction of the wind great, and the temperature variation rapid and extreme. "Cold waves" of great violence have from time to time passed rapidly over large areas of the United States; the temperature oftentimes within several hours showing a fall of thirty degrees Fahrenheit.

The extreme and rapid variations of temperature, notably from a high to a low degree, have a marked and important effect upon the public health; that they are important factors in the cause and severity of disease, if, indeed, they are not a potent power in the production of disease is not seriously doubted; that there are certain influences, the character of which is not definitely known, associated with and accompanying variations from a high to a low temperature and disturbances of the air currents, which directly they increase general sickness, and contribute to the death rate from all causes.

It is an established fact that diphtheria, scarlet fever, pneumonia, bronchitis and other severe and fatal diseases have a maximum prevalence during the season of the year when cold temperature changes occur, and their severity and the fatality attending them varies with the degree and rapidity of these changes.

It is fully recognized also, that in the high, dry, cold and uncrowded localities, where epidemic diseases are comparatively rare; that in the case of all sufferers, whether from acute or chronic disease or from traumatisms, a rapid change from a high to a lower temperature, and the atmospheric disturbances preceding and accompanying them, greatly derange the vital functions; that when from any cause the vital powers are low and resistance thereby impaired, cold weather changes are attended by a greatly increased mortality.

In many northern states, excepting those of high altitude and dry climate, where tuberculosis and other diseases of the air passages are not extensively prevalent, the mortality varies from fifteen to twenty per thousand annually. An examination of the tables of mortality will show that the death rate among adults is from 25 to 40 per cent higher during the months of extreme variations from a high to a low degree of temperature.

In typhoid fever, a disease most prevalent in the summer and fall seasons of the year, it is observed that the percentage of mortality is much increased as the winter months approach; and reaches a maximum death per cent when storm periods are most frequent. In the recent endemic of typhoid fever at Grand Forks, North Dakota, the death rate has been enormous and the mortality increased as the season of cold approached.

In the zymotic diseases—whose prevalence increased with the winter's approach—reach their maximum death rate during the time of maximum storm periods of low temperature. The per cent of deaths to the number of cases reported bearing a direct relation to storms of this character.

Temperature depressions are not so marked as to affect the death rate or contribute to the general ailment in New England and farther south than the 35th parallel, nor west of the valley of the Missouri. The greatest perturbations over high elevations in the more northern latitudes, and in localities otherwise unsurpassed for climatic conditions conducive to health, notably the Dakotas and the high elevations of Minnesota and Nebraska. In the former or humid localities the percentage of death is largely augmented by diseases of an epidermic type and those that arise during the heated season. In the latter or high, dry section, epidermic and hot weather diseases rarely exist extensively, or become at any time seriously disastrous; but the increased amount of general ailments and the greatest mortality from various causes takes place near and at the height of storm periods when the air is unusually dry, wind velocity great and temperature low.

The physician whose field of labor has been in the region of the greatest variation and depression on the great sweep of plains east of the Rockies will bear testimony with me to the fact that a strong relationship between weather changes and health and disease exist, and that his pain-tossed, sleepless, over-stimulated and eventually depressed patient, keeps constantly reminding him that nature has placed a manacle on skill and effort that he is often unable to remove. The writer has more than

once, despite his most earnest efforts, seen patients whose recovery seemed assured under the influence of favorable weather conditions pass into hopeless depression and eventually death under the strain of atmospheric disturbances. It is a time when death more often overtakes the aged and feeble, the organic sufferers and weaklings.

Here the inquiry naturally arises: what are the peculiar characteristics that contribute most toward deranging the vital functions and disturbing the normal healthful equilibrium in the well and vigorous? And more especially what element or elements in these atmospheric variations so add sensitiveness to the already deranged and sensitive organism when under the influence of disease? What influence in this direction has increase and diminution of barometric pressure? Do marked and rapid changes of temperature alone have the controlling effect? How much may be attributed to cold, rapidly moving air currents? What, if any, effect has atmospheric electricity?

It is an established fact that barometric variations have a decided effect on the vascular system and thereby blood pressure, and that a diminution of the pressure even very slight, below the usual range causes alarming and serious results on the robust. It would therefore seem reasonable that rapid barometric variations, especially a diminution, would strongly influence the healthy and still more the ailing. The correspondence noticed between storm periods and barometric variations, together with a low variable temperature existing at these periods, have been assigned as the chief cause for the lack of equilibrium between the external air and the gases of the body and hence morbidity in the healthy and the aggregation of symptoms in the diseased. It is evident to the writer, after considerable observation in a region where extreme changes of temperature are frequent, that a falling or a rising barometer does not sufficiently correspond with marked deviations from health to be assigned as a principal cause.

What effect has low temperature in itself? It is believed by high authority that the cold weather diseases depend upon the presence of non-volatile salts upon the mucous surfaces; that they accumulate by reason of the drying effect of a cold and constantly dry air, and that these diseases prevail more extensively and are relatively more severe "in proportion to the coldness and dryness of the atmosphere." (Dr. Henry M. Baker, secretary of Michigan board of health, "Observation of Cold Weather Diseases.") The observations that led to this belief were made in a damp climate and if the conclusions were correct it would follow that the salts would increase as moisture decreased, and consequently their influence in the causation of disease would be alarmingly augmented in the regions of dry cold winters. With due regard for so high an authority on this subject, it is unnecessary to say that such is not the case, at least in so far as it relates to the three localities referred to in this article.

What effect has the atmospheric electricity? Doubtless much more than has generally been supposed, although not as yet demonstrated. The knowledge gained by recent investigations in electrical science and chemistry leads to the conclusion that meteorological conditions such as exist in high, dry regions subject to changes from a high to a low temperature are such as favor high fluctuating electrical potentials. It has been, I believe, positively demonstrated that as the temperature of any medium or body falls the electrical and magnetic potentials become proportionately increased; that oxygen and other gases and many metals become more highly electricified as the temperature lowers; that friction of cold rapidly moving air currents over long sweeps of country tend to still exalt the electrical potentials; it is thus not unreasonable to conclude that atmospheric electricity has more to do than any other cause with the deviation from health in the healthy and a dangerous depression in those already reduced by disease. For, could it be expected of a sensitively developed organism such as a human being would be omitted where the air and surrounding objects were charged with electricity, whose potentials at these periods is probably constantly fluctuating?

In the application of electricity for the cure of disease the operator is often reminded of its potency by unexpected results, and of the importance of the use of a proper dosage at a time when the vital forces are more delicately balanced, and the body probably made a more sensitive conductor by chemical changes unusual in health.

May it not be that nature at times and certain places varies the electrical potentials regardless of public health by conditions, such as low temperature, dry air, and the in-rushing of upper and colder, electrified air currents? The writer has often observed at times of rapid changes of temperature, notably from a high to a low degree, the velocity of the wind currents great and fluctuating, that friction such as rubbing the feet on carpets would enable one to light a gas-jet by the proximity of a fingerpoint, and that metallic objects would send forth a shock when touched, and the electrical conductivity of a moist room, when the outside conditions were favorable to high electrical potentials, would so charge the atmosphere as to make the presence of electricity felt on entering the room. The writer does not pretend that these suppositions would stand the test of more exact and scientific knowledge, but whether right or wrong, it is clearly evident to him that a different problem confronts the health officer in different regions. In the dry north latitudes, the study of meteorological conditions and their relation to public health—whether conclusions are positive or negative as to their importance in this connection—should doubtless claim a large share of attention. Sanitary science has achieved marvelous results in diminishing sickness and death. Since the seventeenth century the average life of man has been raised from about thirty to fifty-four years. It is probable in the not far distant future there will exist such security that untimely death from large classes of diseases will be rare indeed, when men will live in reasonable security of attaining old age, when an immense burden of sickness, and sorrow for the lost ones will be lifted from the living. In its constant evolution the relation of meteorological conditions to public health will, no doubt, come in for a share of notice and investigation. The United States Meteorological Bureau has given long and

valuable service to investigations for the benefits of commerce and agriculture, and it is hoped that the near future will find it working in conjunction with the boards of public health for a better understanding of this important subject—*Omaha Clinic.*

HARNESSING THE WIND.

The Netherlands Society for the Promotion of Industry has offered a gold medal and $150 for the best paper on the use of windmills and electric accumulators for supplying power to factories. The points especially to be considered are the average energy a common windmill can produce in conjunction with storage batteries, the installation most suitable, the cost per horse power per hour and the economy of the system on a large scale.

In this country a fair measure of success has been attained in harnessing the wind to the performance of menial and domestic service. It has been made to pump water for stock, to grind feed, cut up ensilage and fodder, and in due time it will be employed to furnish electric light for farm residences and yards.

The New York *Press*, in a recent issue, said: "Mr. J. A. Corcoran, of Jersey City, has just completed a novel experiment in the application of a windmill to an electric lighting plant. The plant, though an experimental one, is now in operation without as yet a single mishap, and the storage cells furnish current for twenty-four incandescent lamps in Mr. Corcoran's residence. Everything points to the complete success of the scheme. The mill has a diameter of eighteen feet, and at a speed of twenty miles an hour is capable of delivering three horse-power. The dynamo, driven by belt from the main gear, charges a set of storage batteries. It is so designed that throughout the wide variations of speed of the windmill it maintains the potential constant. Mr. Corcoran says the application of a windmill to run the dynamos of an electric lighting plant will place electricity in the homes of thousands, who can thus secure their motive power from nature. A windmill is not a very costly structure, and any one who owns a bit of open land about his residence can erect one and fit up his simple electrical apparatus inside of it. The thousands of windmills one sees in traveling over the country, if Mr. Corcoran's scheme proves a permanent success, may be utilized for lighting the residences of the owners and those of their neighbors, as well as drawing water for stock. One windmill will light half a dozen residences at the same time. The machine in Mr. Corcoran's windmill occupies a floor space of only thirty inches square and fifteen inches high. The dynamo has a maximum current capacity of thirty-five amperes at thirty-five volts, and is put into action when the speed is 600 revolutions per minute, that is, when an eight-mile breeze is blowing."

In Iowa, it should be noted, the average velocity of wind is above eight miles per hour, especially on the elevated ridges.

By utilizing the waste forces of nature, by means of wind motors, dynamos and storage batteries, we may in due time furnish our homes with light and heat. It is safe to predict that within the first quarter of the coming century vast progress will be made in that direction. The golden age of the world is in the future and not in the past.

JUNE'S PAST WEATHER RECORD.

DES MOINES—15 YEARS' RECORD.

TEMPERATURE—Mean or normal, 70°. The warmest June was that of 1890, with an average of 73°. The coldest June was that of 1889, with an average of 67.° The highest temperature during any June was 101°, on June 14, 1886. The lowest temperature during any June was 37°, on June 1, 1889.

PRECIPITATION—Average for the month, 5.61 inches. Average number of days with .01 of an inch or more, 11. The greatest monthly precipitation was 15.79 inches in 1881. The least monthly precipitation was 1.31 inches in 1886. The greatest amount of precipitation recorded in any 24 consecutive hours was 4.80 inches on June 24, 1879.

CLOUDS AND WEATHER—Average number of clear days, 8. Average number of partly cloudy days, 14. Average number of cloudy days, 8.

WIND—The prevailing winds have been from the south. The highest velocity of the wind during any June was 45 miles, from southwest, on the 5th, 1890.

DAVENPORT—23 YEARS' RECORD.

TEMPERATURE—Mean or normal, 70°. The warmest June was that of 1890, with an average of 74°. The coldest June was that of 1883, with an average of 67°. The highest temperature during any June was 98°, on the 26th, 1890. The lowest temperature during any June was 39°, on the 4th, 1889.

PRECIPITATION—Average for the month, 4.40 inches. Average number of days with .01 of an inch or more, 13. The greatest monthly precipitation was 10.79 inches, in 1892. The least monthly precipitation was 0.49 inches, in 1886. The greatest amount of precipitation recorded in any 24 consecutive hours was 4.36 inches, on the 22d and 23d, 1892.

CLOUDS AND WEATHER—Average number of clear days, 8. Average number of partly cloudy days, 14. Average number of cloudy days, 8.

WIND—The prevailing winds have been from the southwest. The highest velocity of the wind during any June was 60 miles, on the 6th, 1876.

DUBUQUE—20 YEARS' RECORD.

TEMPERATURE—Mean or normal, 69°. The warmest June was that of 1890, with an average of 74°. The coldest June was that of 1889, with an average of 66°. The highest temperature during any June was 98°, on 24th, 1874. The lowest temperature during any June was 40°, on 5th, 1882.

PRECIPITATION—Average for the month, 5.55 inches. Average number of days with .01 of an inch or more, 12. The greatest monthly precipitation was 14.16 inches in 1892. The least monthly precipitation was .71 inches in 1886. The greatest amount of precipitation recorded in any 24 consecutive hours was 3.50 inches on June 23, 1892.

CLOUDS AND WEATHER—Average number of clear days, 7. Average number of partly cloudy days, 12. Average number of cloudy days, 11.

WIND—The prevailing winds have been from the southeast. The highest velocity of the wind during any June was 60 miles, on the 9th, 1879.

KEOKUK—22 YEARS' RECORD.

TEMPERATURE—Mean or normal, 72°. The warmest June was that of 1873, with an average of 78°. The coldest June was that of 1889, with an average of 68°. The highest temperature during any June was 98°, on 26th, 1890. The lowest temperature during any June was 43°, on 1st, 1889.

PRECIPITATION—Average for the month, 4 92 inches. Average number of days with .01 of an inch or more, 12. The greatest monthly precipitation was 9.45 inches in 1882. The least monthly precipitation was 1.21 inches in 1873. The greatest amount of precipitation recorded in any 24 consecutive hours was 3.16 inches on June 19, 1881.

CLOUDS AND WEATHER—Average number of clear days, 6. Average number of partly cloudy days, 15. Average number cloudy days, 9.

WIND—The prevailing winds have been from the south. The highest velocity of the wind during any June was 50 miles, on the 4th, 1874, from south.

APRIL WEATHER REPORT.

The month will rank as one of the most favorable Aprils, for farming operations and crop growth, ever known in this region. The daily mean temperature was about three degrees below the normal.

The average precipitation was somewhat above the normal amount, but the number of storm days was about the average, and no section suffered materially from lack of moisture. This gave favorable conditions for farm work and the time was well improved in seeding and preparing for corn planting.

The following table gives, as a basis of comparison, the mean temperature and total precipitation for the month of April, at the stations named, for the years from 1872 to 1894, inclusive:

YEARS.	MEAN TEMPERATURE, DEGREES.						PRECIPITATION, INCHES.					
	Des Moines.	Davenport.	Dubuque.	Keokuk.	Omaha.	Sioux City.	Des Moines.	Davenport.	Dubuque.	Keokuk.	Omaha.	Sioux City.
1872	....	50	....	54	51	....	.....	5.06	.....	3.86	3.34	.....
1873	....	47	....	48	45	....	.....	3.96	.....	5.65	3.33	.....
1874	....	41	....	44	45	....	.....	2.64	1.54	2.40	2.03	.....
1875	....	46	45	49	45	....	.....	2.30	2.71	0.80	3.06	.....
1876	....	51	49	52	51	....	.....	5.39	3.63	3.90	2.65	.....
1877	....	49	48	51	50	....	.....	3.28	3.74	4.22	6.25	....
1878	...	55	54	57	55	....	.....	2 89	4.34	2.31	3.97	...
1879	51	50	51	52	54	...	1.03	1.54	2.02	1.56	1.77	.....
1880	50	50	48	55	51	..	1.56	4.50	3.51	4.79	3.55	.....
1881	43	45	44	47	44	....	3.36	1.11	1.30	3.12	4.23	.....
1882	51	51	48	54	52	....	3.47	3.15	4.47	3.22	4.31	.....
1883	52	52	50	54	54	....	3.48	3.33	1.93	2.97	3.20	.....
1884	49	50	48	51	48	....	2.97	0.77	2.77	1.31	3.88	.....
1885	49	49	47	50	50	....	3.62	2.47	3.69	3.33	6.34	.....
1886	53	52	51	54	51	....	4.32	1.84	2.12	1.52	1.77	.....
1887	52	52	51	54	54	....	2.48	1.17	1.37	1.84	0.88	.....
1888	51	50	48	54	52	....	1.45	1.57	2.58	1.85	2.06	.....
1889	50	50	49	54	52	....	2.66	3.89	3.56	3.60	1 09	.....
1890	53	53	51	55	55	52	0.78	0.86	2.94	1.79	1.55	1.32
1891	52	52	51	54	54	53	2.12	3.30	1.63	5.06	2.80	2.22
1892	47	47	46	49	48	46	3.36	5.41	4.37	6.16	4.82	4 76
1893	46	47	45	50	48	45	5.61	4.50	4.32	5.41	3.12	3.56
1894	53	53	52	54	54	52	1.70	1.37	2.26	2.75	2.31	2.79
Means	50	49	49	52	51	50	2.75	2.72	2.91	2.84	3.11	2.93

OBSERVERS' NOTES.

Amana.—CONRAD SCHADT: At 3:30 A. M. on the 29th, a house in South Amana was struck by lightning. A gentleman who attempted to put a barrel under a gutter to catch rain water, was struck and was carried into the house senseless. He recovered.

Clinton—LUKE ROBERTS, M. D.: April, 1894, was a very fine month. The first decade was a little lower in temperature than the average of that portion of April, but from the 12th, on which day the last killing frost occurred, the weather continued to warm up to the close of the month. The mean temperature by decades was as follows: First, 41°; second, 53.5°; third, 59°; just the conditions to hasten vegetable growth. Almost the reverse of this characterized the last previous April, viz.: First decade, 53.3°; second, 45.3°; third, 41.4°. The third decade of April, 1894, was the warmest April decade during the last 16 years, except the second decade for 1886, which was the same, but the first decade of that year was wonderfully cold, being only 34.3°. This was the coldest April decade during the last 16 years.

The maximum temperature for the month was 88°; occurring on the 28th. Only one other April for the last 13 years gave higher temperature, namely, 1888, 90°. The average maximum temperature for April is 83.3°. The average minimum temperature for April is 21.40. The minimum for April, 1894, was 24°; and occurring on the 2d and 3d. The warmest day was the 28th, with a mean temperature of 73°. This was 7° above normal for April warm days, and the warmest April day for 16 years by 2°. The mean temperature for the coldest day, which was the 10th, was 35.7°. This was 6.3° above a mean of corresponding days, and, in fact, was the warmest of April cold days, save in April 1888 and 1889. The mean temperature for the month was 52.5°, or 4.1° above normal. It was also the warmest April in 16 years.

The month was deficient in rainfall, although the number of storm days was about normal. The average April rainfall is 3.12 inches, but the April just passed furnished only 1.92 inches. About half of this amount fell on the last two days of the month and was much needed. Much thunder and lightning prevailed on the 29th and 30th, and a little hail on the 30th, which in the south part of the city did some damage to fruit trees.

The movement of wind was below normal both in maximum velocity and total run. The number of miles movement was 5,260, and the maximum velocity 21 miles an hour. The prevailing direction was from the east, though but slightly in excess of southeast, southwest and northwest.

On the morning of the 6th between 2 and 3 o'clock northern lights were visible. The month closed with good forecast for a fruitful season, and everything as far advanced as the average spring. In fact the conditions of soil and the weather were never more favorable for prosecuting spring work in agricultural lines than this month furnished.

Belle Plaine—H. W. VANDIKE: The mean temperature for April is seven degrees warmer than for last April, and four degrees above normal. Plum trees in bloom on

the 28th and apple trees on the 30th—eighteen days earlier than last year. All vegetation is at least three weeks earlier than last year.

College Springs—A. A. BERRY: A dry month. Pastures no further advanced than this time last year. Spring work well advanced. Two weeks earlier than common. Fall wheat, 95%. Fruit, great prospect.

Humboldt—HENRY S. WELLS: Everything is forward two weeks. Ground in fine condition for plowing.

Keosauqua—JOHN H. LANDES: The hail storm of the 28th was one of the most severe that has ever struck this section, continuing for nearly an hour. The hail stones were very large, many of them as large as hen's eggs. The principal damage was done to windows and tin roofs; 2.43 inches of rain fell in about an hour, thoroughly flooding the country and damaging plowed fields, gardens, etc. Some bridges were washed out. On the 17th a man was killed near here by lightning, and his son was knocked senseless at the same time. They were near a wire fence at the time.

ATMOSPHERIC PRESSURE.

STATIONS.	Mean reduced barometer.	EXTREMES.			
		Highest reduced barometer.	Date.	Lowest reduced barometer.	Date.
Cedar Rapids	29.99	30.31	5	29.64	19
Clarinda	29.97	30.38	5	29.55	18
Cresco	.....	30.26	5	29.56	19
Davenport	29.98	30.31	5	29.60	19
Des Moines	29.96	30.34	5	29.53	18
Dubuque	29.97	30.28	2	29.52	4
Keokuk	29.98	30 35	5	29.60	18
Omaha (Neb)	29.96	30.40	5	29.51	18
Sioux City	29.92	30.40	5	29.47	18
Means	29.97	30.40	5	29.47	18

WIND MOVEMENT.

STATIONS.	Number of miles.	Maximum velocity.	Direction.	Date.
Davenport	8,114	48	S	17
Des Moines	7,476	37	W	3
Dubuque	4,806	28	W	3
Keokuk	7,004	42	NW	4
La Crosse (Wis)	.....	.....	.....	.....
Omaha (Neb)	6,968	32	E	8
Sioux City	9,878	46	SE	8

SUMMARY OF WEATHER CONDITIONS.

BAROMETER—Mean pressure for the month, 29.97 inches. Highest observed, 30.40 inches, at Sioux City, on the 5th. Lowest observed, 29.47 inches, at Sioux City, on the 18th. Range for the month, 0.93 inches.

TEMPERATURE—Monthly mean as determined from 65 voluntary observers' reports, 51.7°. Highest monthly mean, 59.2°, at Centerville Lowest monthly mean, 47.0°, at Osage. The highest temperature reported was 93°, at Greenfield, on the 28th The lowest temperature reported was 12°, at Forest City, on the 6th. Average daily maximum, 62.9°. Average daily minimum, 40.8°. Average monthly maximum, 85.0°. Average monthly minimum, 25.0°. Greatest monthly range, 74°, at Atlantic. Least monthly range, 46°, at Sac City. Average range for the State, 60°. Total range for the State, 81°.

PRECIPITATION—Average for the State, as determined from 73 voluntary observers' reports, 3.07 inches. The greatest amount reported, 6.91 inches, at Hampton. The least amount reported, 0 55 inches, at Seymour. The average number of days on which .01 or more inches rain or melted snow fell, 9.2. Average number of cloudy days, 8. Partly cloudy days, 11. Clear days, 11.

FROSTS—Light, Albia, 23d; Cedar Rapids, 1st, 11th; Clarinda, 10th, 11th; Ft. Madison, 2d; Greenfield, 12th, 20th, 21st; Humboldt, 23d; Iowa City, 23d; Sac City, 20th; Alta, 12th, 20th, 21st, 22d.

LUNAR HALO—Amana, 14th, 17th.

SOLAR HALO—Hopeville, 1st, 24th; Iowa Falls, 25th; Ovid, 7th; Alta, 23d, 24th.

THUNDER STORMS—Occurred very generally on the 3d, 9th, 16th, 17th, 28th, 29th, 30th.

HAIL—Audubon, 29th, 30th; Ames, 8th, 29th; Cresco, 17th, 29th; Corning, 7th; Forest City, 29th; Greenfield, 28th; Galva, 28th; Grundy Center, 17th; Humboldt, 18th; Hampton, 28th; Keosaqua, 27th; Monticello, 29th; Newton, 9th, 17th; Osage, 8th; Ovid, 30th; Panama, severe, 17th; Rockwell, 17th; Sac City, 20th; Alta, 28th (size of marbles).

AURORA—Cresco, 9:30 P. M. of the 30th; Monticello, 12th; Sutherland, 20th; Williams, 5th, 7th; Alta, 23d, 24th.

Snow ranged from a trace to one and a half inches.

SLEET—Cedar Rapids, 10th; Greenfield, 8th; Independence, 10th; Osage, 12th; Williams, 4th, 9th, 19th, 20th.

Lunar rainbow reported from Storm Lake on 19th.

SUN DOGS—Independence, 25th; Alta, 23d, 24th.

Excessive precipitation, Keosauqua, 2.43 inches in about one hour.

APRIL SHOWERS.

The month of April in this latitude is noted for frequent showers, and this year brought no exception to the rule. The average rainfall was a little above the April normal, and there were about the usual number of showers, some of them notably severe within narrow areas.

On the 17th a narrow belt of disturbance swept across the central districts from Harrison to Clinton counties. The Missouri Valley *News* gave details of a heavy downpour that occurred in the western part of Harrison county, the amount of rain being variously estimated from six to ten inches. The storm was three to four hours in duration. Many fields were flooded and in the valleys some houses were suddenly inundated, but the damage was only nominal.

Mitchellville, Polk county, on the afternoon of the 17th, was visited by a hail storm which caused considerable destruction of windows and store fronts. The Industrial School buildings suffered heavily. At various points on the line eastward to Clinton county, considerable damage was done by hail and wind.

On the 28th, hail storms of notable severity occurred at Lake City and other points in Calhoun county, at Cherokee causing damage to the amount of $10,000, at Storm Lake and other points along the Illinois Central Railway, and at Glenwood, Mills county. At the latter place many hailstones measured twelve inches in circumference, and one large one weighed eleven ounces. The damage to fruit and gardens was quite heavy. In Cherokee county the hail belt was ten miles in diameter.

METEOROLOGICAL DATA FOR APRIL, 1894.

STATIONS.	TEMPERATURE OF THE AIR (IN DEGREES FAHRENHEIT).								PRECIP. IN INCHES.		Prevailing direction of wind.	Killing frost—last of spring.	No. of cloudless days.	No. of partly cloudy days.	No. of cloudy days.	No. of rainy days. (.01 inch or more).	Hail storms.	No. of thunder storms.
	Monthly mean.	EXTREMES. Mean maximum.	Mean minimum.	Maximum.	Date.	Minimum.	Date.	Monthly range.	Monthly.	Total snowfall.								
Algona	49.7	....	....	77	18	28	1	49	4.81	T	NW	5	14	11	10	....	..	8
Alta	49.4	60.8	38.0	80	27	20	1	60	3.59	0.2	SE	10	6	14	14	....	3	8
Albia	52.8	64.3	41.2	90	28	26	1	64	1.37	...	E	4	16	10	7	....	..	2
Ames	50.3	64.0	36.6	83	28, 29	18	4	65	4.25	..	SE	6	11	13	11	....	..	..
Ames, Heilman, W. H	....	....	....	....	....	....	....	....	4.28	....	....	....	....	....	11	....	2	..
Amana	52.0	62.2	41.9	87	28	25	2	62	2.55	....	SE	10	10	10	10	....	..	6
Atlantic	52.9	66.2	39.6	92	28	18	1	74	1.32	T	NW	11	4	15	7	....	..	3
Audubon	51.8	63.1	40.1	87	28	22	1	65	2.32	....	NW	3	9	18	6	....	2	5
Belle Plaine	52.1	63.3	41.0	87	28	24	2	63	2.04	..	S & SE	5	10	15	10	....	..	..
Bonaparte	53.1	64.4	41.8	89	28	28	1, 2	61	2.83	....	....	....	....	....	....	....	..	..
Carroll	49.9	62.8	37.0	85	28	18	1	67	2.80	....	....	8	11	11	9	....	3	5
Cedar Falls	51.8	63.2	40.4	82	28, 29	23	2	59	2.07	....	S	8	8	14	5	....	..	..
Cedar Rapids	53.2	62.0	44.4	84	28	28	10	56	1.65	....	SW	11	7	12	12	....	..	4
Centerville	50.2	70.8	47.6	89	28	34	1	55	2.30	....	SW	21	6	3	2	....	..	..
Charles City	49.5	57.7	41.3	78	29	25	2	53	4.28	....	S	....	....	....	15	....	..	2
Clarinda	*53.3	63.8	42.8	86	28	30	5	56	2.06	....	SE	10	12	8	8	....	..	..
Clinton	52.7	64.9	40.5	88	28	25	2	64	1.93	..	SW	7	13	10	8	....	1	3
College Springs	54.2	66.9	41.5	90	28	27	11	63	1.50	....	S	9	14	7	6	....	..	..
Corning	*52.9	64.4	41.4	88	28	24	1	64	1.29	....	NW	11	4	15	4	....	..	5
Cresco	48.7	58.7	38.6	78	29	24	3	54	3.21	....	SE	6	9	15	13	....	2	7
Davenport	53.0	62.3	43.8	87	28	30	1	57	1.37	....	E	3	14	13	7	....	..	3
Delaware	48.8	....	....	81	27	28	1	53	2.88	....	S	8	13	9	11	....	..	4
Des Moines	53.1	62.2	43.8	87	28	28	1	59	1.70	T	SE	8	17	5	12	....	2	..
Des Moines (near)	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	..	..
Dubuque	51.8	60.9	42.8	84	28	28	2	56	2.26	....	SE	4	12	14	14	....	..	2
Elkader	50.9	62.5	39.3	82	29	32	2	60	4.16	....	E	11	10	9	11	....	1	5
Emmetsburg	....	....	....	....	....	....	....	....	3.23	....	SE	13	5	12	13	....	..	..
Ft. Madison	56.0	....	....	90	28	32	2	58	1.98	....	SW	5	15	10	3	....	..	4
Forest City	48.2	58.7	37.8	78	27	12	6	66	4.52	....	S	11	4	15	8	....	1	3
Galva	50.5	63.0	37.9	84	28	19	1	65	3.90	....	SE	7	15	8	12	....	1	..
Glenwood	56.2	69.1	43.2	92	27	26	1	66	3.05	....	SE	9	8	13	7	....	..	..
Grand Meadow	49.6	....	....	....	....	....	....	....	4.36	....	SE	3	14	13	13	....	..	3
Greenfield	53.3	66.3	40.2	93	28	24	1	69	2.73	....	SE	6	11	13	9	....	1	2
Grinnell	52.6	61.1	44.2	85	28	30	1	55	2.51	....	SE	....	3	11	14	7	..	1
Grundy Center	50.0	60.1	39.8	82	17	25	1	57	3.31	....	NW	....	9	14	7	10	1	1
Hampton	49.2	59.4	39.1	79	17	24	2, 3	55	6.91	T	SE	..	6	13	11	14	1	4
Hawkeye	....	....	....	....	....	....	....	....	2.89	....	....	....	....	....	....	8	..	..
Hopeville	53.1	64.4	44.8	87	28	25	1	62	1.60	....	SE	....	3	21	6	8	1	5
Hopkinton	53.1	....	....	84	27	33	10	51	2.70	1.5	SE NW	....	....	....	....	6	..	..
Humboldt	....	....	....	....	....	....	....	....	6.24	....	S	..	6	17	7	12	1	2
Independence	49.9	59.9	39.9	81	28	25	2	56	2.44	T	SW	....	9	8	13	6	..	..
Indianola	53.9	65.2	42.6	88	28	26	1	62	1.79	T	NWSW	....	6	12	12	10	..	7
Iowa City	52.6	64.4	40.9	86	28	27	1	59	2.72	....	SE	....	1	21	8	7	..	1
Iowa Falls	48.1	58.2	38.0	80	29	21	1	59	4.83	....	SE	..	10	6	12	9	..	..
Keokuk	54.0	63.0	44.0	88	29	29	2	59	2.75	T	E	....	10	9	11	10	..	3
Keosauqua	53.8	64.4	43.3	87	28	25	2	62	6.04	....	....	....	....	....	....	7	1	1
Larrabee	50.8	63.2	38.5	82	27	19	1	63	4.30	T	....	....	9	12	13	7	3	..
Logan *	54.3	66.7	41.0	91	28	22	1	69	1.88	....	S	....	15	6	9	5	..	..
Le Claire	....	....	....	....	....	....	....	....	1.23	....	....	....	....	....	....	....	..	..
Mason City	52.5	63.3	41.8	79	27	28	22	51	5.15	....	....	....	....	....	....	11	..	..
Maxon	52.7	....	....	90	28	25	1	65	1.60	T	....	....	5	22	3	5	..	1
Mechanicsville	51.0	61.5	40.5	85	28	26	1	59	1.92	0.3	SE	....	7	5	18	11	..	..
Monticello	50.9	60.6	41.0	87	28	25	2	62	3.46	0.1	SE	....	11	9	10	11	1	..
Mt. Vernon	52.8	....	....	83	28	30	2	53	3.00	....	....	....	....	....	....	....	..	..
Murray	....	....	....	....	....	....	....	....	1.14	....	....	....	....	....	....	5	..	5
Newton	52.3	63.3	41.2	86	28	25	1	61	2.41	T	S	....	5	16	9	11	..	..
Omaha (Neb.)	54.0	64.0	44.0	89	28	29	5	60	2.31	....	SE	....	10	9	11	12	..	..
Osage	47.0	....	....	....	....	....	....	....	3.20	....	SE	....	4	9	17	12	1	6
Ottumwa	53.9	63.7	43.9	88	28	27	2	61	2.06	....	E	....	9	13	8	6	..	1
Ovid	53.4	65.7	41.2	88	29	24	1	64	1.23	....	SE	....	6	11	13	7	1	6
Panama	52.3	63.6	41.0	89	28	25	1	64	4.48	....	SE	....	12	8	10	10	1	..
Richland	51.8	....	....	....	....	....	....	....	3.20	....	....	....	5	19	6	10	..	..
Rockwell City	....	....	....	....	....	....	....	....	3.77	T	....	....	13	10	7	7	2	..
Rock Rapids	49.9	62.1	37.6	84	27	21	4	63	5.83	T	SE	....	6	16	8	7	..	..
Sac City	47.9	57.1	38.7	78	27	32	10	46	4.80	....	SE	....	3	13	14	9	1	1
Seymour	53.9	66.4	41.5	96	29	25	1	65	0.55	..	SE	....	19	5	6	2	..	..
Sibley	48.1	60.7	35.5	81	27	18	1	63	4.13	T	SE	....	9	11	10	11	..	..
Sioux City	51.6	61.7	41.5	87	28	24	1	63	2.79	....	SE	....	9	9	13	13	..	..
Spirit Lake	50.3	62.3	38.3	85	17	20	1, 2, 11	65	4.08	T	SE	....	9	6	15	12	..	1
Sutherland	48.3	58.8	37.4	79	29	21	1	58	4.32	0.2	....	....	....	....	....	14	1	6
Vinton	51.4	....	....	78	28	29	1	49	2.21	....	SE	..	14	4	12	6	..	1
Washington	53.6	64.7	42.1	90	28, 29	26	2	64	1.95	1.5	SE	....	....	....	....	4	..	..
Webster City	51.2	....	....	80	29	30	1, 5	50	4.85	0.1	SE	..	8	14	8	10	4	4
Williams	47.8	....	....	80	17	24	2	56	4.51	....	SE	....	7	13	10	12	2	2
Winterset	53.5	65.0	42.1	92	28	25	1	67	1.83	T	E	....	7	8	15	6	..	..
Means	51.7	62.9	40.8	85	.....	26	.....	63	3.07	0.2	SE	....	8	11	11	9.2	..	..

*Not included in means.

DAILY AND MONTHLY MEAN TEMPERATURE FOR APRIL, 1894.

STATIONS.	DATE.																														Monthly Mean.
	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	
Algona	34	43	46	37	41	56	46	40	37	36	40	47	49	52	51	58	62	64	39	35	42	46	51	56	58	64	64	67	64	66	49.7
Alta	35	44	46	36	39	50	49	42	36	37	38	46	50	47	55	52	66	62	41	34	40	47	51	54	61	60	68	66	65	63	49.4
Albia	38	45	55	43	42	53	48	49	42	38	40	44	50	54	57	62	75	66	47	38	42	50	50	54	57	64	65	74	73	67	52.8
Ames	37	42	42	42	40	48	50	45	34	38	40	46	45	50	57	56	60	64	54	44	40	48	50	50	56	62	66	70	72	66	50.3
Amana	37	40	52	41	43	48	45	42	40	36	40	46	50	55	60	61	71	66	50	42	44	48	50	53	58	60	68	73	72	68	52.0
Atlantic	39	48	52	42	44	54	50	46	39	42	40	48	46	52	58	60	69	64	48	37	42	52	50	54	60	63	68	76	73	73	52.9
Audubon	38	46	50	42	40	52	50	44	38	40	38	46	48	50	56	63	69	66	48	36	41	46	50	56	58	62	68	74	72	67	51.8
Belle Plaine	37	40	53	42	42	50	46	48	40	38	40	46	52	54	60	60	72	66	46	41	43	44	47	56	60	60	68	72	72	68	52.1
Bonaparte	40	46	55	46	48	49	52	40	44	37	39	45	48	55	57	62	72	65	54	40	42	48	52	54	58	62	66	74	75	68	53.1
Carroll	35	44	47	44	40	54	55	44	43	38	38	45	45	54	54	62	58	60	41	35	36	50	49	54	58	65	62	66	65	58	49.9
Cedar Falls	35	40	45	42	44	46	50	40	40	36	42	48	48	54	58	58	69	66	59	39	44	50	54	56	58	60	65	68	71	71	51.8
Cedar Rapids	38	42	54	43	45	52	46	42	42	31	41	46	50	56	60	62	70	70	50	44	48	47	52	56	58	60	69	74	72	69	53.2
Centerville	42	45	46	53	52	54	52	49	46	50	61	62	60	62	60	62	63	61	67	67	76	70	66	62	59	62	66	74	72	59	56.5
Charles City	36	38	50	40	44	52	45	40	37	36	39	59	45	48	55	52	64	64	44	38	42	43	50	51	55	57	64	62	69	67	49.5
Clarinda	44	50	52	46	44	51	54	46	37	42	40	47	52	54	58	64	72	63	44	36	41	50	53	56	60	63	67	74	72	64	53.3
Clinton	38	40	41	40	46	46	46	40	40	37	40	44	48	58	62	62	69	70	56	44	49	52	52	54	58	62	68	74	70	72	52.7
College Springs	48	50	53	48	46	53	58	48	43	42	42	46	52	55	56	64	70	64	50	39	40	55	53	55	59	59	67	76	72	64	54.2
Corning	40	47	52	46	44	54	52	46	42	42	39	44	50	52	57	63	67	66	50	37	41	50	52	54	58	63	67	75	72	66	52.9
Cresco	36	38	46	35	42	49	42	40	36	32	37	46	48	52	54	54	62	64	46	40	44	44	52	54	56	58	62	61	67	66	48.7
Davenport	38	42	52	43	44	52	46	40	40	38	41	45	50	56	60	65	71	67	52	42	46	48	54	55	58	60	68	74	73	71	53.0
Decorah	36	37	47	43	42	48	44	40	36	34	39	48	49	53	56	56	61	67	54	42	45	46	51	54	56	58	64	64	67	68	50.1
Delaware	35	40	50	38	40	48	41	39	36	34	38	42	44	52	56	58	60	62	40	40	44	50	51	54	55	59	63	67	63	64	48.8
Des Moines	40	44	52	42	44	54	52	44	40	40	40	48	50	53	58	62	70	68	44	37	42	51	53	56	60	66	68	75	74	67	53.1
Dubuque	40	40	52	40	44	50	44	42	36	36	39	45	47	54	58	60	64	68	53	44	48	51	52	54	58	61	68	71	68	68	51.8
Elkader	38	38	50	39	44	47	47	41	36	40	40	46	45	53	58	60	62	68	50	42	47	50	53	53	56	58	64	66	70	68	50.9
Ft. Madison	44	53	52	46	48	57	51	44	47	42	42	49	57	58	57	70	68	64	52	42	45	53	58	59	63	64	72	76	77	69	56.0
Forest City	35	34	38	44	32	34	51	43	39	34	34	40	47	50	52	48	51	66	55	38	...	...	53	58	57	58	65	65	65	66	48 2
Galva	35	44	49	47	40	50	50	44	38	38	40	45	46	47	56	52	66	62	46	35	40	53	52	53	56	60	70	70	64	66	50.5
Glenwood	45	52	54	48	50	59	57	46	41	48	46	50	49	55	61	65	78	68	49	39	42	49	60	58	62	60	75	77	73	69	56.2
Grand Meadow	36	44	51	36	43	50	44	42	35	33	40	44	46	50	56	58	60	62	46	41	44	46	53	56	58	60	62	67	65	60	49.6
Greenfield	39	48	54	44	42	53	54	48	40	41	39	47	53	51	57	63	65	65	47	39	41	50	58	56	61	63	70	73	72	67	53.3
Grinnell	38	44	52	48	42	52	51	42	42	36	38	46	50	52	58	59	70	66	56	40	40	48	53	55	58	62	67	75	71	68	52.6
Grundy Center	35	44	48	34	44	51	44	41	36	35	40	48	50	54	50	60	68	66	42	34	40	48	53	56	57	62	71	68	69	61	50.0
Hampton	34	40	48	37	41	48	46	38	36	34	40	45	45	52	54	54	67	64	44	36	39	46	52	54	58	60	64	66	68	65	49.2
Hopeville	40	47	50	44	44	52	54	43	40	41	39	48	50	52	58	63	68	66	49	37	44	52	53	58	59	66	68	74	72	62	53.1
Hopkinton	42	46	52	43	47	52	44	43	36	36	44	47	52	54	60	65	65	62	51	44	49	55	56	56	61	65	73	69	70	...	53.1
Independence	36	40	50	38	44	46	40	38	37	36	37	46	47	52	58	58	66	64	44	41	44	46	51	54	56	58	64	68	69	68	49.9
Indianola	40	45	52	53	42	54	52	46	40	40	38	46	50	52	57	62	69	65	56	40	56	51	51	56	58	66	67	75	72	67	53.9
Iowa City	38	42	52	48	44	47	47	40	42	37	40	44	49	56	59	60	71	66	58	42	46	50	50	55	57	61	68	70	72	67	52.6
Iowa Falls	32	40	48	38	40	48	44	44	36	34	32	44	44	...	54	53	67	63	46	35	37	44	49	52	56	...	64	67	69	64	48.1
Keokuk	42	46	56	47	44	54	53	41	46	38	40	46	50	54	61	64	71	64	54	42	43	46	52	56	56	61	68	74	76	69	54.0
Keosauqua	42	44	56	46	46	52	50	42	44	38	39	59	52	54	63	62	73	66	56	42	42	47	53	56	56	64	68	73	73	68	53.8
Larrabee	36	48	50	44	40	52	50	42	38	...	36	46	46	48	54	52	66	60	41	36	40	48	52	54	62	62	68	68	68	68	50.8
Logan	41	48	51	48	44	56	54	49	38	42	40	50	54	59	62	59	69	67	49	36	40	52	56	58	64	59	70	76	75	65	54.3
Mason City	...	...	...	...	...	...	...	...	48	36	40	46	45	48	54	62	62	66	54	38	40	42	48	52	56	58	65	62	67	66	52 5
Maxon	38	49	52	42	40	53	47	44	40	38	39	48	54	53	58	66	70	66	47	37	42	46	54	58	60	64	68	74	62	67	52.7
Mechanicsville	35	41	52	40	42	48	44	38	37	36	38	42	48	53	56	60	67	68	50	42	44	50	53	57	58	60	66	69	69	68	51.0
Monticello	34	42	50	37	40	48	41	43	36	36	40	50	55	47	56	62	64	65	46	42	47	47	53	54	58	58	67	69	67	67	50.7
Mt. Vernon	37	46	50	40	41	51	43	45	38	37	41	46	53	55	62	65	68	67	48	40	45	53	54	56	61	62	70	69	71	70	52.8
Newton	38	43	52	44	42	51	50	44	41	37	38	45	50	53	58	60	71	66	51	38	40	48	53	54	59	64	67	73	72	66	52.3
Omaha (Neb.)	42	50	54	44	44	57	57	42	39	44	41	49	48	51	60	64	71	66	45	36	40	49	56	58	60	64	68	78	72	70	54 6
Osage	33	39	44	36	40	45	40	40	36	34	38	44	45	50	50	51	58	63	42	38	40	43	48	50	55	57	62	64	62	64	47.0
Ottumwa	40	50	54	44	44	54	49	43	42	40	42	48	54	56	58	67	68	65	48	39	43	50	55	57	60	65	70	76	71	66	53.9
Ovid	42	46	53	44	44	52	53	44	41	44	40	46	53	53	58	64	70	66	45	39	44	50	53	56	60	64	66	74	74	66	53.4
Panama	41	47	49	42	42	52	53	45	38	42	39	47	49	48	58	61	66	62	48	34	38	52	54	57	60	64	68	75	72	66	52 3
Richland	37	46	43	41	42	50	48	42	40	35	38	48	52	55	60	58	63	64	47	39	46	47	59	58	59	63	67	74	72	64	51.8
Rock Rapids	34	41	50	30	48	53	54	42	39	36	40	46	50	51	50	54	54	64	40	34	38	48	54	57	62	60	70	66	66	66	49.9
Sac City	46	48	46	38	40	42	49	42	36	35	38	43	44	46	48	48	54	58	44	35	40	46	54	54	55	58	62	60	63	66	47.8
Seymour	42	45	54	44	42	52	54	44	41	46	39	46	46	53	58	64	66	70	56	42	44	54	52	54	60	64	68	74	76	67	53.9
Sibley	33	42	45	37	38	48	48	42	34	36	37	46	46	44	53	50	66	61	46	34	39	44	52	54	60	58	60	64	64	62	48.1
Sioux City	40	48	50	40	42	55	54	41	37	40	40	48	44	48	56	56	68	63	40	34	38	50	55	58	62	61	71	74	68	66	51.6
Spirit Lake	34	42	53	40	38	51	46	44	33	40	38	48	48	54	54	50	70	66	46	34	46	55	53	56	60	63	65	64	60	50	50.3
Sutherland	36	44	44	39	....	48	47	41	36	37	39	45	45	46	56	54	64	62	48	34	39	48	51	58	60	...	...	...	69	69	48.3
Vinton	35	46	52	40	42	51	44	43	38	36	40	46	50	55	57	63	66	63	44	39	43	48	55	56	58	60	68	70	67	65	51.4
Washington	40	44	56	42	44	52	50	48	42	38	38	46	51	57	60	64	73	66	48	40	41	51	55	56	58	62	68	74	75	67	53.6
Webster City	44	46	50	46	41	48	44	38	36	38	38	47	48	52	53	60	62	63	42	35	41	46	50	57	57	64	68	74	71	70	56	51.2
Williams	34	42	47	38	40	48	46	36	34	34	39	42	46	48	52	57	63	62	42	34	41	45	51	54	55	61	68	74	64	63	48.6
Winterset	40	46	52	44	42	54	54	46	45	40	40	47	50	52	58	64	68	66	46	37	42	52	53	58	62	66	68	77	76	67	53.5

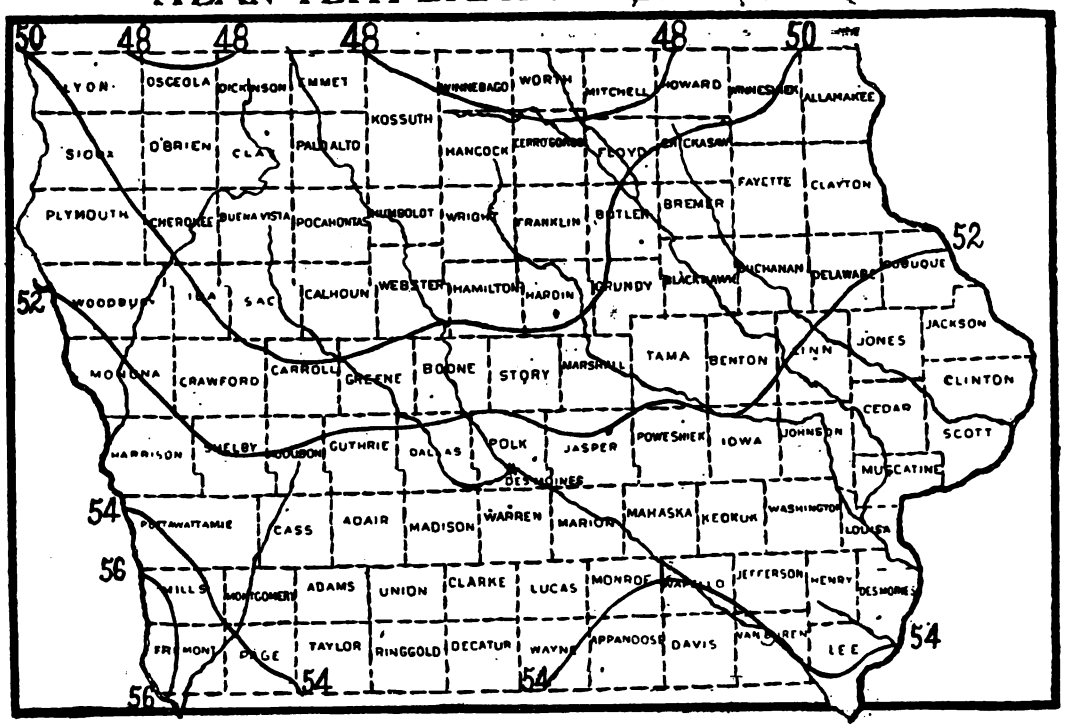
MAXIMUM AND MINIMUM TEMPERATURE FOR APRIL, 1894.

STATIONS.	1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		Mon'y Mean.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Alta	50	20	59	28	57	36	40	33	54	23	66	32	64	34	51	33	37	34	46	28	51	24	59	34	59	41	52	42	63	47	71	34	76	50	48	35	40	28	49	31	61	33	70	39	69	40	74	48	78	43	80	55	79	54	72	58	73	53	60.8	38.0
Ames	52	22	62	23	60	23	65	18	57	22	67	28	62	37	56	34	44	24	44	32	49	30	58	33	52	38	60	41	68	46	78	34	79	41	77	51	65	43	55	32	47	32	62	33	69	31	69	32	70	43	76	48	79	52	83	56	83	61	73	59	64.0	36.6
Albia	50	26	60	30	60	50	46	40	54	30	66	40	60	36	63	35	45	38	44	32	50	29	59	30	67	34	66	42	70	44	80	45	84	66	78	54	52	42	44	32	52	33	60	40	66	34	68	40	74	40	78	51	80	50	90	57	87	59	76	58	64.3	41.2
Amana	46	28	56	25	59	44	43	39	54	32	66	31	53	35	51	34	41	39	40	33	47	34	57	35	64	36	64	46	70	49	77	45	82	60	76	57	54	45	49	35	50	37	58	39	66	34	68	38	71	46	75	46	82	54	87	59	85	60	73	62	62.2	41.9
Atlantic	60	18	66	29	65	40	48	37	62	25	72	37	71	28	56	35	42	36	55	29	53	26	65	31	52	39	57	46	67	49	80	46	78	60	76	52	59	36	43	31	47	36	64	40	72	28	73	34	76	44	83	43	80	57	92	61	86	60	86	60	66.2	39.6
Audubon	54	22	63	29	60	40	48	37	55	25	70	34	65	35	53	35	42	35	50	30	49	26	60	32	53	42	55	45	64	49	77	49	79	59	75	58	60	37	42	31	49	33	59	32	68	33	70	41	72	44	77	46	79	56	87	62	83	60	75	59	63.1	40.5
Belle Plaine	48	26	57	24	62	44	44	39	55	30	68	31	58	34	52	33	42	38	42	33	49	32	57	35	67	38	64	44	71	48	78	42	85	59	78	55	52	40	49	33	50	36	59	38	62	32	71	41	73	46	73	47	84	53	87	58	85	60	76	61	63.2	41.0
Bonaparte	53	28	64	28	63	47	53	39	56	39	68	30	62	41	46	36	49	40	41	33	46	32	58	32	62	36	67	43	71	43	80	45	82	60	74	56	65	43	46	35	48	35	60	37	69	35	68	40	71	45	75	48	82	50	89	58	88	62	73	62	64.4	41.8
Carroll	52	18	63	25	50	35	52	36	56	24	72	35	74	36	52	36	48	38	48	28	50	26	58	32	52	38	72	36	68	40	78	46	72	44	74	46	47	35	41	29	42	30	62	38	68	30	69	38	71	46	78	52	76	48	85	46	75	55	71	44	62.8	37.0
Cedar Falls	45	25	57	33	60	30	50	35	57	30	60	33	65	34	48	33	45	35	41	31	48	35	59	36	57	40	62	45	67	48	78	37	79	59	74	57	75	43	45	33	50	38	65	35	72	35	71	41	72	45	75	45	80	50	82	55	82	60	75	67	63.2	40.4
Cedar Rapids	47	30	56	28	58	50	46	40	54	36	65	39	53	40	47	36	46	37	43	34	47	35	56	37	62	38	64	47	69	52	75	48	78	52	79	60	57	44	50	37	55	40	58	36	65	38	68	44	69	47	73	48	80	58	84	64	82	62	74	64	62.0	44.4
Centerville	50	34	53	37	55	37	65	41	65	40	66	42	65	40	60	38	58	35	60	40	72	50	73	51	70	50	71	52	72	48	73	51	75	51	72	50	79	55	81	53	88	53	85	55	80	53	74	50	70	48	72	51	76	56	89	60	85	59	70	48	70.8	47.6
Charles City	46	26	50	25	55	44	45	35	55	32	64	40	56	34	45	34	38	36	40	32	44	34	60	38	50	40	50	46	62	48	66	37	72	57	70	58	51	38	41	36	50	34	54	32	65	36	66	36	70	40	73	41	75	52	70	53	78	60	70	64	57.7	41.3
Clarinda	57	31	65	35	62	42	54	38	57	39	68	34	72	37	51	40	40	34	55	32	52	28	61	33	58	46	60	47	67	50	78	50	78	67	73	55	51	38	40	33	48	34	59	41	68	38	70	43	70	49	70	47	78	56	86	62	82	63	76	52	63.8	42.8
Clinton	51	26	56	24	58	24	43	38	56	36	65	28	54	28	50	31	45	35	40	34	48	32	60	29	65	31	69	47	77	48	81	44	81	57	82	59	66	47	51	37	57	41	62	42	68	36	70	38	75	41	79	44	85	50	88	59	83	58	82	62	64.9	40.5
College Springs	61	34	68	32	65	41	57	39	60	31	72	34	75	41	57	38	50	36	55	29	57	27	60	32	65	39	66	44	68	45	79	49	81	59	74	55	61	39	46	32	47	33	63	47	71	35	71	39	70	48	81	37	78	56	90	61	83	61	76	52	66.9	41.5
Corning	57	24	64	30	63	42	52	30	59	28	70	37	71	32	55	37	46	37	53	30	51	27	62	27	57	42	59	46	65	49	79	47	77	57	75	57	60	40	42	32	48	34	60	41	68	35	69	40	69	47	79	47	77	57	88	62	84	61	74	59	64.4	41.4
Cresco	46	25	52	24	53	40	37	33	53	30	67	31	52	32	47	32	40	31	36	29	42	32	57	35	56	39	59	44	66	43	70	38	69	54	74	54	52	39	47	33	54	34	57	31	67	34	69	40	69	43	73	44	77	47	77	57	88	62	84	61	74	59	64.4	41.4
Davenport	47	30	55	30	60	44	46	40	52	36	64	39	52	40	48	32	44	36	43	33	48	34	56	34	62	38	65	46	70	49	78	52	83	59	74	60	56	47	48	36	54	39	56	41	67	40	68	42	71	46	71	50	80	56	87	62	86	60	79	63	62.3	43.8
Decorah	45	26	52	22	54	40	50	36	52	32	65	31	54	34	49	32	38	34	37	30	45	33	59	36	58	40	64	42	67	45	73	40	72	50	76	58	65	43	50	34	54	36	58	34	69	33	72	35	73	40	75	40	77	50	75	53	79	55	75	62	61.1	39.2
Des Moines	52	28	59	30	60	44	44	41	56	31	70	37	62	42	53	36	44	37	47	34	49	32	58	37	57	42	50	47	65	50	78	45	77	62	76	50	49	39	41	33	48	35	60	42	67	39	68	45	71	48	76	55	78	57	87	63	84	63	72	62	62.2	43.8
Dubuque	46	34	51	28	58	46	42	38	52	36	64	36	51	38	52	32	38	35	38	33	45	33	56	34	58	36	62	46	70	46	74	46	72	57	78	58	58	48	50	37	56	40	60	42	65	40	68	41	71	44	74	48	82	55	84	58	78	58	74	62	60.9	42.8
Elkader	48	29	55	32	58	43	41	37	55	34	66	28	57	37	50	32	37	34	49	31	47	33	61	31	57	33	61	45	70	46	79	41	73	52	78	58	57	42	48	36	57	37	62	38	72	34	72	34	74	38	76	41	81	46	80	51	82	57	74	61	62.5	39.3
Forest City	48	22	44	24	45	32	56	32	39	26	55	12	66	36	55	31	44	34	38	30	36	32	45	34	55	39	58	41	59	44	62	33	67	35	80	53	70	40	43	32	37	..	47	..	60	46	71	45	71	43	71	45	78	52	76	54	75	55	76	56	58.7	37.8
Galva	61	19	60	28	61	37	59	35	56	24	68	33	67	33	53	35	40	35	48	28	54	27	61	29	49	42	50	44	68	44	71	33	76	57	74	52	51	37	35	40	30	48	38	33	72	34	73	38	79	42	82	57	78	49	75	58	63.0	37.9
Glenwood	64	26	69	34	68	41	57	40	72	28	78	40	76	38	54	36	48	34	66	30	64	28	65	34	54	44	62	48	70	52	80	50	90	66	77	58	58	40	46	32	50	45	62	36	80	40	71	44	72	52	80	40	92	58	96	64	80	66	78	60	69.1	43.2
Greenfield	55	24	68	27	64	44	52	36	58	25	72	35	70	39	50	37	44	39	51	31	52	26	63	30	63	43	59	42	65	49	81	44	81	49	79	52	57	37	48	30	49	33	60	39	71	46	75	36	76	46	81	45	83	56	93	53	86	59	75	58	66.3	40.2
Grinnell	47	30	56	31	59	45	53	42	52	32	65	38	60	42	50	35	45	39	40	32	45	32	55	36	59	42	60	45	65	50	74	44	80	61	72	59	72	41	45	36	45	35	55	40	63	43	65	45	67	50	70	53	76	58	85	65	82	60	71	64	61.1	44.2
Grundy Center	45	25	57	32	59	36	41	28	55	32	67	35	55	32	47	35	40	31	39	31	46	33	57	38	57	44	61	47	66	35	76	45	82	54	74	47	52	32	38	32	46	33	57	36	66	40	68	44	74	50	80	58	78	56	79	59	72	50	60.1	39.8
Hampton	45	24	55	24	57	40	40	34	55	27	66	31	57	35	46	31	38	34	38	31	47	32	56	34	53	38	61	43	62	47	73	36	79	55	75	54	50	37	40	31	46	32	54	32	67	36	68	39	70	45	74	47	79	50	77	56	78	57	71	60	59.4	39.1
Hopeville	55	25	64	30	63	38	50	38	59	28	69	35	68	40	51	35	42	37	50	32	50	28	61	34	61	39	59	45	68	49	79	47	76	61	74	57	59	39	42	32	54	34	64	40	69	37	70	47	71	47	81	50	80	55	87	51	85	60	71	54	64.4	41.8
Independence	46	24	56	25	57	43	42	35	54	33	62	31	46	35	45	30	44	30	38	34	43	31	57	34	59	35	60	45	68	47	76	41	76	57	74	53	46	43	36	32	50	38	65	36	67	40	69	43	73	44	79	49	81	54	80	58	78	58	59.9	39.9
Indianola	54	26	60	29	60	45	65	40	56	27	70	37	66	39	57	35	44	35	46	33	48	29	58	34	60	39	59	45	65	49	79	44	79	60	76	57	70	43	49	31	64	48	61	41	67	35	68	43	70	45	80	57	79	55	88	62	83	61	74	61	65.2	42.6
Iowa City	50	27	56	28	61	43	57	39	55	33	66	28	61	43	49	32	47	37	42	32	48	33	56	32	64	34	66	45	71	47	77	44	84	58	78	55	70	45	49	34	54	37	61	38	68	32	69	41	70	44	79	48	83	53	86	59	73	61	64	40	64.4	40.9
Iowa Falls	43	21	55	25	56	40	44	32	54	26	65	32	55	33	56	31	40	33	35	30	45	31	55	32	51	37	..	..	61	46	72	34	77	57	73	53	57	36	39	31	43	31	55	33	64	34	67	37	68	43	..	..	75	52	76	58	80	58	71	58	58.2	38.0
Keokuk	52	32	62	29	62	50	52	42	55	33	69	39	60	46	46	36	52	41	42	35	45	34	57	34	65	36	65	44	71	51	79	50	83	59	72	57	56	51	46	37	49	37	56	37	65	38	69	44	67	46	72	50	82	55	86	63	88	64	76	62	63.0	44.0
Keosauqua	54	29	62	25	63	48	50	41	58	33	68	35	61	39	48	37	48	40	42	35	45	33	65	36	67	36	65	44	71	55	79	44	84	62	72	58	64	48	48	36	47	38	59	35	70	36	70	43	72	42	76	52	81	54	87	59	84	62	72	63	64.4	43.3
Larrabee	52	19	59	38	58	43	54	35	56	24	69	34	65	35	49	34	49	28	..	..	51	22	62	31	51	41	53	43	63	45	70	35	78	55	74	47	49	33	42	29	47	32	63	32	72	33	70	38	75	48	81	43	82	54	80	56	78	58	80	55	63.2	38.5
Logan	60	22	65	30	68	34	60	36	62	25	74	38	73	36	56	42	41	35	55	30	54	25	64	35	64	44	70	48	73	50	78	40	78	60	78	56	58	40	42	30	51	30	65	40	74	38	73	42	77	50	74	44	84	56	91	64	87	63	81	49	66.7	41.0
Mason City	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	65	31	39	34	47	32	52	40	51	39	55	41	65	42	70	54	73	50	78	55	67	40	43	33	48	32	56	28	65	31	69	36	71	42	74	43	79	51	73	51	78	56	75	58	63.3	41.8
Mechanicsville	44	26	54	28	57	47	43	37	51	33	65	30	52	36	46	30	39	35	42	31	44	32	53	31	60	35	62	44	68	45	74	46	77	57	80	58	55	44	50	34	55	33	58	41	68	38	72	42	74	43	78	46	84	48	85	53	81	57	75	60	61.5	40.5
Newton	51	25	60	26	61	43	50	38	56	29	69	33	62	38	54	33	45	37	51	33	46	30	58	32	61	39	62	44	67	48	77	43	82	60	75	56	64	38	43	32	47	34	60	37	69	37	68	41	72	46	76	52	81	53	86	60	84	60	73	60	63.3	41.2
Omaha (Neb.)	56	29	65	35	66	41	49	40	58	29	72	42	75	41	49	35	43	35	55	32	53	29	63	35	55	44	58	44	70	51	78	50	78	64	78	58	53	37	41	32	46	35	60	38	69	43	67	48	68	51	79	49	77	60	89	66	88	66	78	61	64.0	44.0
Ottumwa	51	29	61	27	62	47	53	41	55	33	70	37	61	43	51	36	48	40	52	35	46	33	58	36	61	38	65	47	69	49	78	45	83	62	75	58	62	44	45	35	46	37	57	43	66	31	62	44	70	47	75	54	81	55	88	64	86	64	72	63	63.7	43.9
Ovid	59	24	64	29	62	44	51	38	61	27	70	33	68	38	53	35	45	37	53	34	52	27	60	33	70	36	60	46	69	48	81	46	80	60	76	55	51	39	45	33	56	33	66	34	72	34	70	42	73	47	77	51	79	54	87	60	88	66	72	60	65.7	41.2
Panama	57	25	64	30	63	35	47	38	58	26	68	37	69	37	54	36	42	35	50	33	52	26	63	31	57	41	55	40	67	50	78	44	73	59	71	52	59	37	39	29	44	33	63	40	69	38	69	45	72	47	72	47	78	58	89	61	80	64	75	57	63.6	41.0
Rock Rapids	40	28	48	34	60	40	38	21	68	29	70	36	73	34	50	34	46	32	44	28	55	24	60	31	63	37	60	42	62	38	68	40	75	34	73	55	43	37	38	29	47	29	67	30	73	35	72	42	77	46	82	40	84	55	81	50	74	58	73	60	62.1	37.6
Sac City	56	35	57	39	56	37	42	33	44	36	49	36	63	35	50	33	37	34	38	32	44	32	53	38	52	45	54	39	56	40	59	38	67	41	74	42	47	40	38	32	46	33	64	43	68	41	67	43	70	47	78	46	76	45	78	48	78	61	64	0	64.0	38.7
Seymour	58	25	60	30	62	45	50	38	57	28	69	35	68	40	54	34	44	38	55	28	50	28	60	33	68	25	60	46	68	48	82	45	83	50	84	55	68	45	50	33	53	34	64	45	68	36	69	40	72	47	78	50	82	54	88	60	90	62	74	60	66.3	41.5
Sibley	48	18	58	26	54	36	42	32	53	23	68	29	62	35	50	33	37	32	44	28	51	23	61	30	54	37	51	38	59	47	68	33	78	53	73	49	59	33	39	28	48	30	61	27	71	33	71	36	75	44	78	39	81	39	78	49	78	49	70	55	60.7	35.5
Sioux City	56	24	62	33	58	41	44	36	60	25	70	40	68	40	47	35	40	34	52	29	55	26	62	34	47	41	50	45	64	49	71	42	75	61	72	54	45	35	39	30	47	29	63	38	69	41	66	49	72	51	78	44	82	60	87	60	77	50	74	59	61.7	41.5
Spirit Lake	47	20	63	20	64	42	48	33	58	19	70	32	60	32	55	34	35	31	47	32	55	20	62	33	60	35	60	49	61	46	65	35	85	54	78	53	60	32	37	31	60	32	65	45	71	35	72	41	77	44	80	46	78	52	72	56	62	57	62	57	62.3	38.3
Sutherland	51	21	60	27	51	36	45	34	..	..	23	63	33	59	35	48	34	38	34	45	29	51	27	61	29	50	41	51	40	63	48	70	35	77	51	73	51	59	38	39	29	47	31	63	32	71	32	69	46	74	46	..	39	..	..	..	78	..	79	58	71	56	58.8	37.4
Winterset	55	25	62	30	61	42	50	39	58	27	70	38	68	40	58	35	52	38	49	32	51	28	60	34	58	43	59	45	68	48	83	44	76	60	77	56	50	41	43	31	49	34	63	41	70	36	72	43	75	48	82	50	80	56	92	62	85	56	74	60	65.0	42.1

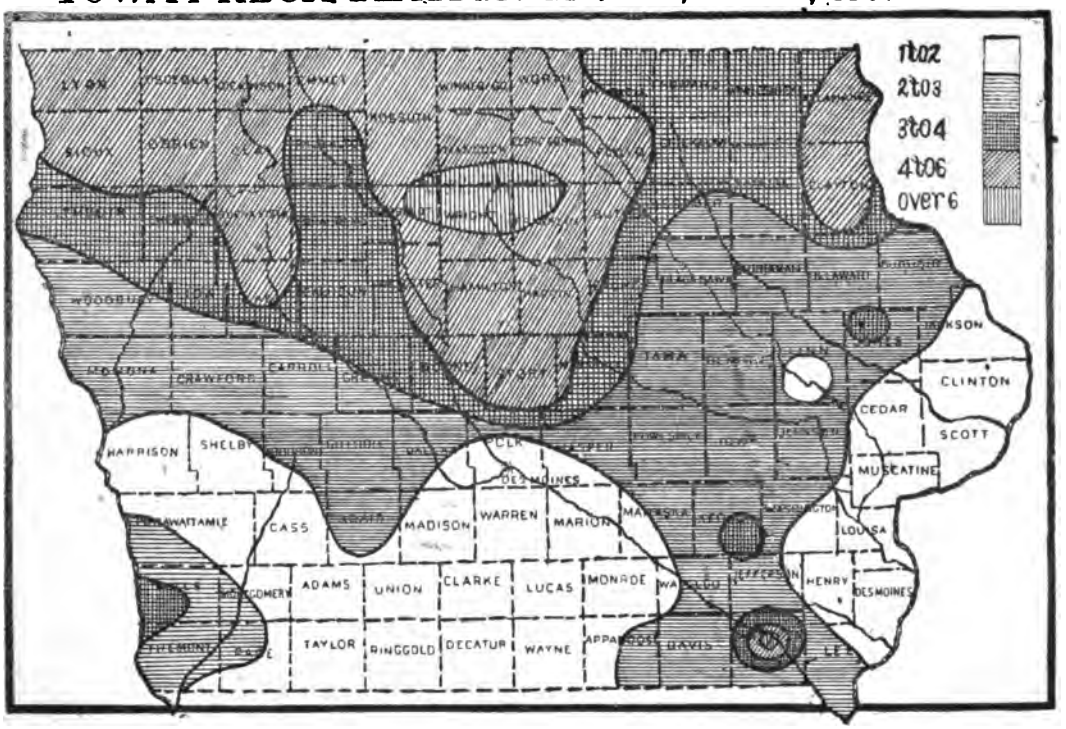
DAILY AND MONTHLY PRECIPITATION FOR APRIL, 1894.

STATIONS.	DATE. 1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th	27th.	28th.	29th.	30th.	Total.
Algona	....	....	T	0.02	....	....	....	....	1.20	T	....	....	....	0.07	0.03	0.09	0.10	....	0.90	0.05	....	....	....	....	....	....	....	0.60	1.75	....	4.81
Alta	....	0.13	....	0.03	....	....	....	0.33	....	....	....	....	0.11	0.20	....	0.03	....	0.46	0.03	....	....	....	....	....	....	0.17	....	0.63	0.75	0.72	3.59
Albia	....	....	....	....	....	....	....	....	0.69	....	....	....	....	0.01	....	0.03	0.20	0.03	0.02	....	....	....	....	....	....	T	T	T	0.29	0.10	1.37
Ames Ex. station	....	....	0.04	....	0.03	....	....	1.17	....	....	....	....	....	0.09	0.02	....	....	0.15	....	0.06	0.02	....	....	....	....	....	....	0.14	1.91	0.65	4.28
Ames	....	....	....	0.03	....	....	....	....	1.18	0.03	....	....	....	0.09	0.02	....	....	0.13	0.03	0.02	....	....	....	....	....	....	....	0.15	1.88	0.69	4.25
Amana	....	....	0.02	....	....	....	....	....	1.05	0.02	....	....	T	....	0.05	T	T	0.14	0.05	0.02	0.13	....	....	....	....	....	....	....	0.18	0.89	2.55
Atlantic	....	....	0.05	....	....	....	....	0.82	....	....	....	....	0.14	0.25	....	....	0.10	....	....	....	....	....	....	....	....	....	T	0.05	0.11	..	1.52
Audubon	....	....	....	....	....	....	....	0.85	....	....	....	....	0.20	....	0.15	....	....	0.22	....	....	....	....	....	....	....	....	....	....	0.30	0.60	2.32
Belle Plaine	....	....	0.03	T	....	....	....	....	0.86	0.02	....	....	T	....	0.07	....	0.29	0.05	0.02	0.15	....	....	....	....	....	....	T	....	0.25	0.30	2.04
Bonaparte	....	....	0.07	....	....	....	....	0.95	0.16	....	....	....	....	....	....	....	....	....	0.17	0.23	....	....	....	....	....	....	....	0.29	0.33	0.63	2.83
Carroll	T	....	....	1.06	....	....	....	0.74	....	....	....	....	0.29	....	0.01	....	0.24	....	0.31	0.10	....	....	....	....	T	T	T	T	0.67	0.38	2.80
Cedar Falls	....	....	T	T	T	....	....	....	1.40	T	....	....	T	....	....	....	0.65	0.20	0.02	....	....	....	....	....	....	....	....	....	....	1.00	2.08
Cedar Rapids	....	....	0.03	0.01	0.04	....	....	....	0.62	0.08	....	....	T	0.02	T	T	0.11	0.10	T	0.06	0.05	....	....	....	....	....	T	....	0.23	0.30	1.65
Centerville	....	....	....	....	....	....	....	....	....	1.25	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	T	1.05	2.30
Charles City	....	T	0.05	0.09	....	....	....	0.20	0.50	0.03	....	....	0.15	0.05	....	....	1.06	0.05	0.03	0.13	....	....	....	....	....	....	....	0.15	0.16	0.88	0.75	4.28
Clarinda	....	....	....	....	....	....	....	0.78	....	....	....	....	....	0.38	....	....	0.19	0.05	0.22	0.05	....	....	....	....	....	....	....	....	0.12	0.25	2.06
Clinton	....	....	....	....	....	....	....	....	0.59	0.10	0.05	....	....	....	....	....	0.13	0.17	....	0.08	....	....	....	....	....	....	T	....	0.40	0.51	1.93
College Springs	....	....	....	....	....	....	....	0.61	....	....	....	....	....	0.46	....	....	0.16	0.02	0.16	T	T	....	....	....	T	....	T	T	T	0.09	1.50
Corning	....	....	....	....	....	....	....	....	0.67	....	....	....	T	0.18	....	....	T	0.11	....	T	....	....	....	....	....	....	T	T	0.33	....	1.29
Cresco	....	....	0.06	T	0.02	0.01	....	....	0.08	T	....	....	0.08	T	0.02	....	0.75	0.10	T	0.06	....	....	....	....	....	....	T	0.22	0.18	0.52	0.11	3.21
Davenport	....	....	T	0.01	....	....	T	0.55	T	T	....	....	....	0.01	T	0.06	T	T	0.01	T	....	....	....	....	....	....	T	T	0.01	0.72	1.35
Decorah	....	....	0.15	T	....	....	0.07	....	0.90	....	....	....	0.03	....	....	....	1.22	....	0.07	T	....	....	....	....	....	....	0.35	....	0.28	0.57	3.64
Delaware	....	0 07	0.04	....	....	....	....	0.10	0.47	....	....	....	0.04	....	....	....	0.43	0.02	0.05	0.03	....	....	....	....	....	....	....	....	0.92	0.71	2.88
Des Moines	....	....	0.02	0.02	T	....	....	0.01	0.57	T	....	....	0.01	0.02	T	....	0.08	0.13	0.06	0.02	T	....	....	....	....	....	T	....	0.74	0.02	1.70
Dubuque	....	....	0.05	0.04	....	....	....	....	0.76	0.02	T	....	0.01	0.01	....	....	0.19	0.02	0.01	0.05	....	....	....	....	....	....	0.01	0.02	0 23	0 84	2.26
Elkader	....	T	....	T	....	....	....	....	0.64	0.02	....	....	0.04	T	....	....	1.09	0.25	0.03	0.09	....	....	....	....	....	....	0.06	1.03	0.63	0.28	4.16
Emmetsburg	....	....	0.07	0.02	....	....	....	0 45	0.27	....	....	....	0.04	0.23	....	....	0.10	0.49	0.05	T	....	....	....	....	....	....	0.03	0 83	1.02	0.03	3.93
Ft. Madison	....	....	T	....	....	T	....	0.86	T	0.12	....	....	....	T	....	....	T	T	T	T	....	....	....	....	....	....	....	T	....	1.00	1.98
Forest City	....	....	....	0.05	....	....	....	....	1.39	T	....	....	T	0.17	....	....	0.55	0.38	1.27	T	....	....	....	....	....	....	T	0.35	0.36	T	4.52
Galva	....	....	0.08	0.05	....	....	....	0.24	0.05	....	....	....	0.44	0.23	0.01	....	....	1.03	0.07	T	....	....	....	....	....	....	....	0.30	0.52	0.07	3.09
Glenwood	....	....	....	....	....	....	....	0.98	....	....	....	....	0.15	0.52	....	....	....	....	0.28	0.06	....	....	....	....	....	....	....	....	0.98	0.08	3.05
Grand Meadow	....	T	0.12	T	0.04	....	....	....	T	0.73	....	....	T	T	....	....	2.04	0 04	0 14	0.13	....	....	....	....	....	....	0.17	0.05	0.65	0.25	4.36
Greenfield	....	....	....	T	....	....	....	T	0.76	T	....	....	T	....	0.03	T	T	0.22	....	0.08	....	....	....	....	0.02	0.02	T	0.63	0.89	0.08	2.73
Grinnell	....	....	T	T	....	....	....	T	0.95	0 01	....	....	T	T	....	....	0.20	T	0.30	0.20	....	....	....	....	....	....	T	0.65	0.65	0.20	2.51
Grundy Center	....	0.02	....	0.02	....	....	....	0.76	0.05	T	....	....	T	....	....	....	1.36	....	0.06	0.12	....	....	....	....	....	....	....	0.24	0.46	0.22	3.31
Hampton	....	0.06	....	0.04	....	....	....	0.96	0.14	0.04	....	....	....	0.14	0.04	....	0.44	2.40	....	0.04	0.08	....	....	....	....	....	0.05	0.36	1.96	0.16	6.91
Hawkeye	....	....	....	....	....	....	....	....	0.60	....	....	....	....	....	....	....	0.80	....	....	....	....	....	....	....	0.05	0.10	0.18	0.06	0.11	0 99	2.89
Hopeville	....	....	T	....	....	....	....	....	0.63	0.13	....	....	....	0.02	....	....	0.03	....	....	0.02	....	....	....	....	0.01	....	....	....	0.56	0.20	1.60
Hopkinton	....	....	T	T	T	....	....	....	....	0.85	0.05	....	T	....	....	....	0.53	....	0.05	0.02	....	....	....	....	....	....	....	....	1.00	0.25	2.70
Humboldt	....	....	0.06	T	0.02	....	....	....	0.76	....	....	....	0.34	0.08	....	....	0.15	2.70	0.03	0.05	....	....	....	....	....	....	....	0.26	1.76	0.03	6.24
Independence	....	....	T	T	....	....	....	....	0.50	T	....	....	T	T	....	....	0.50	0.12	0.02	T	....	....	....	....	....	....	T	....	0.90	0.40	2.44
Indianola	....	....	....	T	....	....	....	T	0.60	....	....	....	0.03	0.03	T	T	0.32	0.02	0.19	0.05	....	....	....	....	....	0.03	T	....	0.47	0.05	1.79
Iowa City	....	....	....	T	....	....	....	....	1.36	T	....	....	....	T	0.04	0.08	0.02	T	T	0.09	....	....	....	....	....	....	....	....	0.03	1.10	2.72
Iowa Falls	....	....	0.04	0.02	....	T	....	0.04	0.88	0.01	....	....	0.06	....	0.01	....	1.05	0.33	....	0.68	....	....	....	....	....	T	....	T	1.57	0.20	4.83
Keokuk	....	....	T	....	....	....	....	T	1.31	....	....	....	....	T	T	....	0.83	T	T	0.03	0.07	....	....	....	....	....	....	2.43	0 70	0.67	6.04
Keosauqua	0.14	T	0.04	....	....	....	....	0.59	....	....	T	0.14	0.30	....	0.11	0.36	T	0.19	....	....	....	....	....	....	0.26	0.14	0.63	1.12	0.28	4.30
Larrabee	....	....	....	....	....	....	....	0.88	0.02	....	....	0.37	0.41	....	....	....	....	0 20	....	....	....	....	....	....	....	....	....	....	....	....	1.88
Logan	....	....	....	....	....	....	....	0.61	0 13	0.02	....	....	....	....	....	....	0.17	....	0.02	0.01	....	....	....	....	....	....	....	....	0.25	0.02	1.23
Le Claire	....	....	....	....	....	....	....	....	1.20	....	0.50	....	....	....	0.10	....	0.10	1.35	....	0.20	0.01	....	....	....	....	....	0.12	0.23	1.25	0.09	5.15
Mason City	....	....	....	....	....	....	....	T	0.60	T	....	....	....	T	....	....	....	0.38	T	0.15	T	....	....	....	....	T	....	....	0.07	0.40	1.60
Maxon	....	....	0.01	0.03	....	....	....	0.20	0.50	0.01	0.01	....	....	0.01	....	T	0.01	0.01	0.02	0.01	....	....	....	....	....	....	T	....	0.20	0.90	1.92
Mechanicsville	....	....	0.68	0.02	0.01	....	....	....	0.59	0.03	....	....	....	....	....	....	0.63	....	0.03	0.06	....	....	....	....	....	....	....	....	0.47	0.94	3.46
Monticello	....	....	T	T	....	....	....	....	0.57	....	....	....	0.03	0 05	....	....	....	....	0.11	....	....	....	....	....	....	T	T	....	....	0 38	1.14
Murray	....	....	0.03	0.08	....	....	....	T	0.73	T	....	....	T	0.02	....	....	0.25	0.29	0.07	0 08	0.01	....	....	....	....	T	T	....	0.64	0.21	2.41
Newton	....	....	0.01	0.07	T	....	0.01	....	0.30	0.42	T	....	....	0.01	....	....	1.70	0.27	0.10	T	0.01	....	....	....	....	....	0.15	0.25	0.78	....	4.06
North McGregor	....	....	0.02	T	....	....	....	0.81	0.02	....	....	0.36	0.48	0.02	....	....	0.01	0.22	0.20	0.08	....	....	....	....	0.07	....	T	0.02	T	T	2.31
Omaha (Neb.)	....	....	0.03	0.03	0.01	....	....	0.82	....	....	0.04	0.09	....	....	0.48	0.45	....	0.16	....	....	....	....	....	....	....	0.12	0.19	0.78	....	....	3.20
Osage	....	....	....	....	....	....	....	0.80	....	T	....	....	....	T	....	T	T	0.40	0.06	0.09	....	....	....	....	T	....	....	....	0.18	0.53	2.06
Ottumwa	....	....	0.05	....	....	....	....	0.35	....	....	....	....	....	0.01	....	....	....	T	....	0.11	....	....	....	....	....	0.07	....	....	0.28	0.36	1.23
Ovid	....	0.03	....	....	....	....	....	0.72	....	....	0.25	....	....	0.45	....	....	1.71	0.10	0.14	0.05	....	....	....	....	....	....	....	....	0.13	0 90	4.48
Panama	....	0.05	....	0.02	....	....	....	....	1.48	T	....	....	....	0.04	....	....	....	0.39	0.08	0.17	....	....	....	....	....	....	....	0.11	....	0.86	3.20
Richland	....	....	....	....	....	....	....	0.70	....	....	....	0.31	0 05	....	....	....	0.87	....	T	....	....	....	....	....	....	....	....	0.96	0.57	0.31	3.77
Rockwell City	....	....	....	T	....	....	....	1.32	....	....	....	....	....	0.30	....	0.92	....	0.16	T	....	....	....	....	....	....	....	....	0.54	1.13	1.46	5.83
Rock Rapids	....	....	0.10	....	....	....	....	1.00	....	....	....	....	0.75	0.25	....	....	0.10	0.50	T	T	....	....	....	....	....	....	0.10	1.25	....	0.75	4.80
Sac City	T	....	....	....	....	....	....	....	0 13	....	....	....	....	....	....	....	....	T	T	T	....	....	....	....	....	....	....	....	0.42	T	0.55
Seymour	....	....	0.02	0.05	....	....	....	0.67	....	....	....	....	T	0.39	0.05	....	0.25	0.29	0.03	....	....	....	....	....	....	....	....	0.39	1.84	0.15	4.13
Sibley	....	....	0 03	T	....	....	....	0.68	0.01	....	....	....	0.07	0.52	0.01	....	0.02	0.24	0.31	0.01	....	....	....	....	....	....	T	0.04	0.72	0.13	2.79
Sioux City	....	....	0.04	0.03	....	....	....	0.75	0.26	....	....	....	....	0.37	....	0.01	0.20	0.32	0.10	0.01	....	....	....	....	....	....	0.15	1.85	....	....	4.08
Spirit Lake	....	....	0.02	0.06	....	....	....	0.71	....	....	....	....	0.04	0.41	0.01	....	0.22	0.27	0.02	....	....	....	....	....	0.01	....	0.33	0.90	1.25	0.08	4.33
Sutherland	....	....	....	....	....	....	....	....	....	....	....	....	....	0.35	....	....	0.16	....	....	0.18	....	....	....	....	....	....	....	....	....	....	0.69
Villisca	....	T	T	T	....	....	....	....	0.75	....	....	....	T	....	....	....	0.41	0.26	....	0.15	....	....	....	....	....	....	....	0.27	0.38	....	2.21
Vinton	....	....	....	....	....	....	....	....	0.82	0.15	....	....	....	....	....	....	....	....	....	0 03	....	....	....	....	....	....	....	....	....	0.05	1.05
Washington	....	0.10	....	0.10	....	....	....	....	....	1.25	....	....	0.40	T	....	0.25	1 25	0.25	....	0 60	....	....	....	....	....	....	T	0....	....	....	....

MEAN TEMPERATURE, APRIL, 1894.



IOWA PRECIPITATION CHART, APRIL, 1894.



METEOROLOGICAL STATIONS AND OBSERVERS.

From the following, weekly and monthly reports of Meteorological data are received by the Iowa Weather and Crop Service.

Albia	Cal Koontz.
Albia (Maxon)	Gus Johnson.
Algona	C. D. Pettibone.
Alta	D. E. Hadden.
Amana	Conrad Schadt.
Ames (Exp. Station)	W. H. Helleman.
Ames	Fred L. Kent.
Atlantic	J. W. Love.
Audubon	J. F. Hocker.
Belle Plaine	H. W. Vandike.
Blakeville	James Rodgers.
Bonaparte	Hon. B. R. Vale.
Carroll	Moses Simon.
Cedar Falls	Prof. A. C. Page.
Cedar Rapids	H. D. Olds.
Centerville	Prof. H. E. Reister.
Charles City	J. W. Smith.
Clarinda	A. S. Van Sandt.
Clinton	Luke Roberts.
College Springs	A. A. Berry.
Corning	John W. Bixby.
Cresco	Gregory Marshall.
Council Bluffs	E. W. Hart.
Davenport	*F. J. Walz.
Delaware	Wm. Ball.
Decorah	F. H. Baker.
Denison	M. E. Lies.
Des Moines	*Geo. M. Chappel, M. D.
Dubuque	*S. C. Emery.
Eagle Grove	C. A. Schaffter.
Eldora	Prof. C. F. Woodward.
Elkader	Chas. Reinecke.
Emmetsburg	J. A. Carmichael.
Fairfield	J. Fred Clarke, M. D.
Fayette	R. Z. Latimer.
Ft. Madison	Miss L. A. McCready.
Forest City	J. A. Peters.
Galva	W. A. Crowley.
Glenwood	Seth Dean.
Greenfield	J. G. Culver.
Grinnell	Prof. S. J. Buck.
Grundy Center	Chas. G. Rogers.
Hampton	E. C. Grenelle.
Hawkeye	J. W. Bopp.
Hopeville	M. T. Ashley.
Hopkinton	Theo. Marks
Humboldt	H. S. Wells.
Independence	E. F. Wulfke.
Indianola	Prof. J. L. Tilton.
Iowa City	Prof. A. L. Arner.
Iowa Falls	J. B. Parmelee.
Jefferson	Dr. Chas. Enfield.
Keokuk	*Fred. Z. Gosewisch.
Keosauqua	Prof. J. H. Landes.
Knoxville	Casey and Reeves.
Larrabee	H. B. Strever.
Logan	Mrs. M. B. Stern.
Mason City	H. I. Smith.
Marshalltown	L. S. Kilborn.
Maquoketa	Dr. A. B. Bowen.
Mechanicsville	Rev. J. W. Hubbard.
Mooar	F. G. Thomas
Monticello	Henry D. Smith
Mount Vernon	Prof. A. Collin.
Mt. Ayr.	Hon. Wm. Shriver.
Mt. Pleasant	Dr. Max E. Witte.
Murray	A. W. Lewis.
Muscatine	J. P. Walton.
Newton	A. Lufkin.
Omaha, Neb.	*Geo. E. Hunt.
Ovid	H. C. Miller.
Osage	G. D. Pattingill.
Oskaloosa	Jos. Boyd.
Ottumwa	L. J. Baker
Panama	Wm. J. Wicks.
Postville	F. L. Williams.
Richland	Wm. A. Shaffer.
Rock Rapids	W. C. Wyckoff.
Rockwell City	G. B. Rigg.
Seymour	Mrs. C. A. Conger.
Sibley	H. G. Doolittle.
Sidney	G. V. Swearingen.
Sioux City	*U. G. Pursell.
Sac City	Dr. C. Brown.
Spirit Lake	W. C. Drummond.
Tipton	J. M. Rider.
Toledo	Chas. Mason.
Vinton	T. F. McCune.
Villisca	Paul Welch.
Washington	Wm. A. Cook.
Webster City	C. M. Trumbauer.
Winterset	Will McKnight.
West Bend	Phil. Dorweiler.
Williams	M. L. Fuller.

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Met. 217

THIS NUMBER CONTAINS THE

June Crop Report.

UNITED STATES DEPARTMENT OF AGRICULTURE,
WEATHER BUREAU.

JUN 22 1894
LIBRARY

MONTHLY REVIEW

OF THE

Iowa Weather and Crop Service.

VOL. V. —MAY, 1894.—NO. 5.

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1894.

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MONTHLY REVIEW

OF THE

IOWA WEATHER AND CROP SERVICE.

IOWA AGRICULTURAL COLLEGE
JUN 22 1894
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VOL. V.] MAY, 1894. [No. 5.

IOWA CROP REPORT, JUNE, 1894.

SUMMARY OF REPORTS FROM NEARLY ONE THOUSAND CORRESPONDENTS, REPRESENTING EVERY COUNTY IN THE STATE.

ACREAGE AND CONDITION OF CROPS—CONDITION OF LIVE STOCK, ETC.

The season of 1894 opened unusually early, and has been exceedingly variable, with unprecedented range of temperature. The first and second decades of March brought daily temperature averaging 15 degrees above the normal.

The last decade was the coldest on record for that period in March, the temperature reaching the zero point in nearly all portions of the State. Seeding and plowing were checked, and considerable damage was done to early sowed grain. April was favorable for farm work, and the daily temperature was about three degrees above the normal. May was variable, the periods of unseasonably high temperature being followed by damaging frosts, the range being from 90 degrees to the frost line. The freezing weather on the 19th and 20th checked the advancement of all crops, and seriously damaged fruit, tender vegetation and spring grain in many localities. The most damaging condition has been the unprecedented drouth, prevalent through the larger part of May and the first decade of June. The summarized reports of correspondents, made about June 1st, show the following results:

WINTER WHEAT—The conditions were unfavorable for seeding last fall, and the acreage of this crop appears to have been reduced 11 per cent, making the present acreage 207,863 acres. The condition averages 81 per cent.

SPRING WHEAT—There is an average reduction of 9 per cent in the acreage, making the present area only 564,770 acres. Condition June 1st, 89 per cent. The total yield of spring and winter wheat is estimated at about eight and a half million bushels, against about eleven million bushels last year.

CORN—The reports show an increase in the acreage of corn in every county. The average increase for the State appears to be 12 per cent, which is probably an under estimate. This would give an acreage of 6,738,970 acres. The condition of the crop June 1st averaged 101 per cent. It is unusually clean, and has made an excellant stand.

OATS—There has been an average decrease of 3 per cent in the acreage of oats, making a present acreage of 4,029,719 acres. The average condition is placed at 85 per cent. The bulk of these reports were made from the 29th to 31st of May, since which time the drouth increased in severity, and oats suffered more than any other grain crop. On the 9th of June there was no prospect of more than two-thirds of an average crop in the State, and in some districts it cannot exceed 50 per cent.

RYE—Decrease in acreage 6 per cent, making the present number of acres 102,957. Average condition, 88 per cent.

BARLEY—Reports show a decrease of about 1 per cent in the acreage of barley sown, making the present acreage 501,031 acres. Condition, 87 per cent.

TIMOTHY—Decrease in acreage, 2 per cent; average condition June 1st, 74 per cent.

CLOVER—Acreage, same as last year; condition, 77 per cent.

MILLET—Increase in acreage, 2 per cent; condition, 87 per cent.

BROOM CORN—No change in acreage; condition, 94 per cent.

IRISH POTATOES—Acreage increased 11 per cent. Present number of acres, 115,729; condition, 96 per cent

SWEET POTATOES—No change in acreage; condition, 96 per cent.

CONDITION OF FRUIT—Apples, 82 per cent; peaches, 57; pears, 74; plums, 79; grapes, 69; strawberries, 66; raspberries, 78; blackberries, 86; cherries, 81.

CONDITION OF STOCK—Cattle, 100; sheep, 99; hogs, 100; spring pig crop, 94; horses, 98; foals, 80.

MISCELLANEOUS—Condition of soil, 103; date of last frost, May 31; date of first corn planting, April 1, in Page county. The season is 13 days earlier than average.

Reports from about 400 well posted correspondents show that the average amount of corn in the hands of the producers is 16 per cent of last year's crop, or a little over 34 million bushels. The amount of oats on hand is estimated to be 11 per cent, or about 11 million bushels.

TABLE SHOWING INCREASE OR DECREASE IN CROPS.

COUNTIES.	WINTER WHEAT.		SPRING WHEAT.		CORN.		OATS.		RYE.		BARLEY.		TIMOTHY.		CLOVER		MILLET		BROOM CORN.		IRISH POTATOES.		SWEET POTATOES.	
	Increase.	Decrease.	Increase.	Decrease.	Increase.	Decrease	Increase.	Decrease.	Increase.	Decrease.	Increase.	Decrease.	Increase.	Decrease.	Increase.	Decrease.	Increase.	Decrease.	Increase.	Decrease.	Increase.	Decrease.	Increase.	Decrease.
Adair	...	5	6	...	15	...	...	12	...	9	3	...	...	17	...	7	10	...	0	...	14	...	3	...
Adams	...	16	...	10	9	...	...	22	0	0	0	0	...	21	...	20	...	10	...	...	4	...	2	...
Allamakee	...	43	...	20	9	...	0	0	...	14	...	8	2	...	...	2	20	...	...	...	22	...	...	...
Appanoose	...	4	0	0	15	...	...	23	0	0	0	0	...	9	...	13	1	...	4	...	16	...	8	...
Audubon	2	...	1	...	12	...	...	13	0	0	...	8	2	...	11	...	8	...	...	...	...	6	5	...
Benton	...	8	...	7	7	...	2	...	...	11	6	...	...	8	...	5	...	...	...	...	3	...	...	...
Black Hawk	...	...	...	...	6	...	0	0	0	0	5	...	...	1	...	4	23	...	...	...	6	...	0	0
Boone	...	10	...	1	10	...	...	4	...	5	...	2	0	...	7	...	2	...	1	...	9	...	1	...
Bremer	...	...	...	15	10	...	...	4	...	5	5	...	...	2	...	6	...	5	...	...	8	...	...	...
Buchanan	...	...	...	...	7	...	...	6	...	15	...	...	...	12	0	...	...	...	...	...	8	...	...	12
Buena Vista	0	...	0	...	4	...	8	...	1	...	...	18	...	7	...	32	...	35	0	...	13	...	0	...
Butler	...	...	...	5	10	...	...	6	...	5	0	...	...	7	...	8	6	...	...	...	17	...	0	...
Calhoun	...	...	5	...	14	...	...	12	...	5	3	...	3	...	...	3	6	...	...	...	0	...	...	...
Carroll	...	4	...	1	10	...	...	2	...	4	...	3	1	...	3	...	...	0	5	...	3	...	...	2
Cass	...	2	...	1	15	...	...	3	...	17	...	2	...	5	4	...	2	...	...	...	5	...	20	...
Cedar	...	1	...	6	8	...	3	...	...	2	4	...	...	3	...	4	...	...	...	...	10	...	...	10
Cerro Gordo	...	...	...	5	11	...	2	...	...	1	5	...	0	...	...	3	2	...	...	...	10	...	...	...
Cherokee	...	...	...	8	9	...	3	...	...	11	...	10	...	6	...	9	...	...	...	...	16	...	...	...
Chickasaw	...	20	...	15	10	...	5	...	0	0	5	...	10	...	...	18	0	0	0	0	8	...	...	...
Clarke	...	9	...	...	15	...	...	23	...	19	...	...	...	5	7	...	9	...	...	...	8	...	8	...
Clay	...	...	...	8	15	...	...	1	...	8	...	4	6	...	9	...	...	5	...	10	15	...	...	...
Clayton	...	40	...	60	8	...	15	...	...	10	...	7	5	...	10	...	...	10	...	...	25	...	...	...
Clinton	...	3	...	8	8	...	...	7	5	...	...	15	2	...	5	...	...	5	...	...	9	...	...	...
Crawford	0	...	2	...	13	...	...	12	7	...	...	2	...	13	13	...	...	4	...	...	6	...	...	15
Dallas	10	...	...	6	12	...	...	14	...	10	...	...	...	8	...	6	4	...	...	...	12	...	5	...
Davis	...	11	...	...	13	...	1	...	...	10	...	...	...	4	...	5	10	...	...	...	14	...	13	...
Decatur	...	1	...	10	20	...	...	15	...	1	0	0	...	8	...	6	15	...	2	...	16	...	6	...
Delaware	...	16	...	20	8	...	0	0	...	5	5	...	...	8	...	1	...	...	...	...	11	...	5	...
Des Moines	...	21	...	5	12	...	2	...	5	...	...	...	...	7	5	...	3	...	...	...	11	...	2	...
Dickinson	...	...	...	4	10	...	4	...	...	10	...	4	7	...	5	...	...	...	...	...	2	...	...	...
Dubuque	...	28	...	14	8	...	...	2	...	4	4	...	1	...	4	...	...	...	0	0	7	...	...	...
Emmet	...	...	...	8	20	...	5	...	...	20	2	...	2	...	20	...	...	...	...	...	8	...	...	...
Fayette	...	18	...	16	9	...	2	...	...	9	...	6	...	2	...	4	3	...	0	0	8	...	...	5
Floyd	...	12	...	8	9	...	...	4	1	...	...	2	...	6	...	6	6	...	...	...	12	...	...	...
Franklin	...	...	...	5	7	...	7	...	...	5	...	10	1	...	...	1	0	0	...	...	6	...	...	...
Fremont	...	21	...	17	11	...	...	17	...	6	...	...	...	2	...	3	...	1	...	...	7	...	4	...
Greene	...	15	...	8	8	...	0	0	2	...	...	10	2	...	5	...	...	10	...	...	2	...	3	...
Grundy	...	...	9	...	6	...	...	1	...	19	...	1	...	3	0	0	5	...	...	...	12	...	5	...
Guthrie	...	8	...	4	10	...	...	14	...	3	0	0	6	...	10	...	4	...	0	0	13	...	6	...
Hamilton	...	...	...	6	13	...	1	...	...	30	5	...	...	8	...	8	5	...	...	25	13	...	0	0
Hancock	...	...	...	16	12	...	...	2	...	8	0	0	4	...	...	8	...	3	...	...	6	...	...	...
Hardin	...	...	4	...	7	...	...	2	...	9	...	...	2	...	4	1	...	...	...	...	7	...	2	...
Harrison	...	35	...	8	13	...	2	...	...	22	...	...	8	...	2	...	12	...	...	5	13	...	...	8
Henry	...	14	...	...	6	...	...	8	0	...	...	...	...	9	1	...	...	...	...	...	5	...	2	...
Howard	...	5	...	1	6	...	2	...	...	1	0	...	2	...	0	0	0	0	...	...	6	...	...	...
Humboldt	...	28	...	12	10	...	3	...	...	2	...	2	...	10	...	19	2	...	...	10	8	...	5	...
Ida	...	50	...	11	9	...	...	4	...	45	...	6	7	...	4	...	...	8	...	...	10	...	12	...
Iowa	...	25	...	6	4	...	...	2	...	15	2	...	...	2	1	...	...	6	...	5	5	...	...	6
Jackson	0	0	...	8	10	...	0	0	...	5	...	10	5	...	5	...	3	...	...	1	8	...	...	10
Jasper	...	11	...	12	11	...	...	6	...	9	...	17	...	5	...	2	2	...	0	0	9	...	3	...
Jefferson	...	4	...	60	12	...	3	...	6	30	...	...	...	10	...	8	3	...	2	...	13	...	1	...
Johnson	...	6	...	7	8	...	1	...	...	2	0	0	...	8	7	...	3	...	4	...	2	...	...	...
Jones	...	...	...	3	10	...	...	6	...	5	22	...	...	5	...	4	...	...	...	...	16	...	...	...
Keokuk	...	11	...	3	13	...	...	10	...	6	...	...	...	5	2	...	...	...	...	...	4	...	2	...
Kossuth	...	...	...	42	45	...	35	...	...	...	...	20	120	...	100	...	...	...	...	...	100	...	...	...
Lee	...	13	...	1	8	...	...	5	...	5	...	...	...	16	...	7	12	...	5	...	17	...	1	...
Linn	...	12	...	4	6	...	0	...	...	6	...	5	...	4	1	...	6	...	...	5	7	...	...	5
Louisa	...	5	0	0	11	...	...	6	...	5	...	8	...	5	2	...	...	...	...	...	17	...	5	...
Lucas	...	13	...	...	18	...	...	21	...	4	28	...	...	6	...	7	11	...	0	0	9	...	3	...
Lyon	...	...	...	18	20	...	4	...	...	2	...	2	18	...	...	10	...	5	...	...	18	...	...	...
Madison	2	...	...	16	14	...	...	11	9	...	0	0	...	8	...	5	...	5	45	...	18	...	0	0
Mahaska	...	8	...	24	16	...	...	8	...	3	...	...	...	10	...	9	...	...	10	...	1	...	6	...
Marion	2	...	...	19	16	...	...	8	...	4	...	25	...	8	...	1	...	5	...	5	6	...	...	2
Marshall	...	3	...	1	10	...	...	5	...	8	3	...	...	5	...	3	7	...	0	0	16	...	...	...
Mills	...	7	...	13	11	...	4	...	...	16	0	0	...	11	1	...	8	...	...	...	7	...	...	3
Mitchell	17	...	...	2	12	...	...	7	8	...	...	3	...	6	...	5	3	...	...	...	11	...	...	...
Monona	...	24	10	...	15	...	6	...	...	1	2	...	...	16	...	1	...	6	...	...	7	...	15	...
Monroe	...	7	...	5	18	...	...	16	0	0	...	...	...	11	...	10	...	20	...	...	17	...	...	10
Montgomery	6	...	...	9	12	...	3	...	0	0	...	...	...	6	1	...	12	...	...	...	9	...	...	2
Muscatine	...	11	...	10	10	...	11	...	...	12	2	...	...	16	...	11	...	...	...	...	9	...	5	...
O'Brien	...	...	...	2	13	...	2	...	...	15	2	...	7	...	3	...	18	...	...	...	22	...	...	...
Osceola	...	...	...	15	18	...	...	4	...	3	6	...	2	...	0	0	...	...	...	...	20	...	...	...
Page	...	12	...	...	20	...	...	10	5	...	...	...	...	10	...	10	15	...	...	...	5	...	...	...
Palo Alto	...	...	0	0	11	...	6	...	1	...	...	10	8	...	7	...	0	0	...	5	10	...	10	...
Plymouth	...	...	...	10	12	...	10	...	...	2	...	10	10	...	5	...	5	...	...	...	...	10	...	...
Pocahontas	...	...	1	...	14	...	...	10	2	...	6	...	3	...	...	2	4	...	...	...	...	1	0	0
Polk	6	...	...	2	12	...	...	8	...	2	...	...	...	11	...	1	...	...	0	0	1	...	...	2
Pottawattamie	...	1	1	...	9	...	...	6	...	6	0	0	...	5	6	...	4	...	5	...	18	...	...	8
Poweshiek	...	4	...	5	12	...	...	9	...	1	16	...	...	1	2	...	...	...	...	...	12	...	...	5
Ringgold	...	1	...	2	26	...	...	12	...	2	...	...	...	10	...	9	...	...	0	0	6	...	...	1
Sac	...	6	0	0	10	...	...	2	...	2	2	0	0	...	...	1	3	...	0	0	4	...	...	...
Scott	...	6	...	3	9	...	4	...	...	1	...	6	...	1	1	0	0	5	...	...	10	...	...	5
Shelby	...	5	...	15	9	...	...	4	10	...	...	12	0	0	12	...	3	...	...	...	15	...	3	...
Sioux	...	...	...	17	14	...	5	...	...	2	3	...	10	...	17	...	16	...	...	...	14	...	...	...
Story	...	16	...	4	10	...	...	5	...	6	...	8	...	7	...	5	...	2	9	0	14	...	...	2
Tama	...	50	...	2	9	...	...	6	...	35	18	...	...	4	...	5	...	5	...	5	18	...	...	...
Taylor	...	11	...	33	21	...	...	26	...	3	...	...	...	5	...	3	...	2	...	...	22	...	...	2
Union	...	...	5	...	14	...	...	24	5	...	0	0	...	12	...	8	12	...	...	...	8	...	...	5
Van Buren	...	2	...	25	12	...	...	2	...	12	...	...	...	4	18	...	...	...	...	...	9	...	...	5
Wapello	...	9	...	...	9	...	...	7	...	2	...	...	...	7	0	0	5	...	...	...	5	...	...	5
Warren	...	16	...	13	14	...	...	8	...	0	...	10	...	8	...	2	10	...	...	5	13	...	3	...
Washington	...	30	...	40	12	...	...	3	...	11	...	5	...	8	...	9	25	...	...	...	11	...	...	...
Wayne	...	1	...	5	18	...	...	20	5	...	...	...	...	10	...	1	...	0	1	...	9	...	...	3
Webster	...	...	3	...	9	...	...	2	0	0	15	...	...	5	...	8	0	0	...	5	8	...	5	...
Winnebago	...	...	...	19	17	...	9	...	...	...	2	...	...	2	12	...	2	...	...	...	9	...	...	...
Winneshiek	...	18	...	12	8	...	2	...	...	16	4	...	1	...	2	...	4	...	3	...	16	...	...	...
Woodbury	...	25	...	16	11	...	...	5	...	5	...	21	...	13	...	16	11	...	...	...	15	...	...	...
Worth	...	30	...	12	9	...	0	0	...	10	1	...	...	3	...	10	...	22	...	...	8	...	...	...
Wright	...	...	...	7	9	...	4	...	...	12	3	...	...	4	...	0	...	2	...	...	7	...	...	...
Average	...	11	...	9	12	...	...	...	...	6	...	1	...	2	...	0	2	...	0	0	11	...	1	...

TABLE SHOWING AVERAGE CONDITION OF CROPS AND STOCK.

COUNTY.	Winter wheat, per cent.	Spring wheat, per cent.	Corn, per cent.	Oats, per cent.	Rye, per cent.	Barley, per cent.	Timothy, per cent.	Clover, per cent.	Millet, per cent.	Broom corn, per cent.	Irish potatoes, per cent.	Sweet potatoes, per cent.	Apples, per cent.	Peaches, per cent.	Pears, per cent.	Plums, per cent.	Grapes, per cent.	Strawberries, per cent.	Raspberries, per cent.	Blackberries, per cent.	Cherries, per cent.	Cattle, per cent.	Sheep, per cent.	Hogs, per cent.	Spring pig crop, per cent.	Horses, per cent.	Foals, per cent.	Condition of soil, per cent.	Date of first corn planting.	No. days early.
Adair	84	70	112	78	82	70	48	62	100	....	103	92	74	....	....	73	60	40	74	91	97	98	97	101	92	100	62	96	Apr. 25	11
Adams	72	85	102	60	75	80	38	48	50	....	85	100	84	100	75	100	58	48	81	90	82	98	100	95	89	94	76	90	Apr. 23	12
Allamakee	48	85	95	105	72	97	100	97	....	....	100	....	68	80	80	87	95	68	93	97	90	100	100	100	83	88	67	102	Apr. 25	13
Appanoose	96	100	110	86	96	....	80	84	93	100	105	99	112	52	112	106	99	104	106	107	114	103	104	100	104	99	74	125	Apr. 15	14
Audubon	62	75	99	79	85	86	62	68	90	....	80	....	73	....	75	77	68	64	97	97	71	95	95	102	86	90	80	90	Apr. 25	12
Benton	62	94	105	97	86	91	83	75	90	....	98	....	80	50	....	68	52	56	64	70	83	103	97	97	95	94	87	103	Apr. 20	11
Black Hawk	....	....	102	101	97	105	78	80	78	....	98	80	85	....	105	76	66	65	81	81	70	99	97	106	102	102	84	108	Apr. 5	12
Boone	80	82	99	77	81	90	51	65	71	....	86	71	71	....	....	68	48	36	56	63	77	99	94	98	89	102	85	101	Apr. 16	12
Bremer	..	110	104	113	104	....	86	83	85	....	98	....	84	100	95	90	81	91	90	83	80	102	100	101	99	100	97	122	Apr. 26	14
Buchanan	....	....	109	114	95	....	79	81	100	....	105	85	106	....	....	110	83	79	70	78	52	108	105	108	102	98	95	111	Apr. 15	18
Buena Vista	....	91	101	99	105	95	86	81	60	....	92	....	91	....	....	86	74	71	78	82	58	102	103	99	94	101	81	105	Apr. 23	8
Butler	....	99	103	99	98	102	74	76	102	90	104	....	78	....	....	91	69	69	79	86	84	102	101	103	104	97	83	100	Apr. 15	12
Calhoun	....	97	101	82	95	85	66	78	97	....	93	....	76	....	....	85	42	71	79	79	68	103	105	99	99	99	79	107	Apr. 15	15
Carroll	90	77	99	79	83	88	69	72	79	....	93	60	83	100	60	83	53	65	76	89	76	97	103	99	92	99	86	102	Apr. 20	11
Cass	77	68	102	61	58	66	48	69	70	....	90	92	90	....	....	93	60	42	71	80	109	94	96	102	109	100	92	103	Apr. 24	11
Cedar	86	95	104	102	100	81	89	91	....	....	103	80	66	....	....	77	69	71	82	88	82	97	98	98	92	99	81	107	Apr. 20	8
Cerro Gordo	....	102	106	105	105	101	86	77	80	....	105	....	96	....	....	97	65	78	97	96	85	102	103	101	94	89	84	111	Apr. 25	13
Cherokee	....	83	97	85	75	82	65	65	76	....	96	....	56	....	....	81	51	58	61	64	55	100	95	100	102	102	82	94	Apr. 20	15
Chickasaw	90	103	99	106	100	90	100	98	100	100	100	....	86	....	....	73	71	61	85	78	75	102	102	100	106	100	78	105	Apr. 25	18
Clarke	81	83	107	59	84	....	52	64	90	90	91	82	81	....	84	85	78	80	87	99	92	98	96	98	93	98	83	100	Apr. 11	18
Clay	....	85	99	92	70	91	84	83	75	80	90	....	68	....	....	65	32	50	60	....	75	100	98	102	81	95	92	95	Apr. 25	12
Clayton	75	90	102	105	98	90	89	97	90	....	93	....	103	....	....	88	82	78	88	98	95	98	95	98	100	93	80	108	Apr. 30	10
Clinton	100	100	100	104	100	....	103	99	....	....	102	....	84	....	....	80	85	80	90	93	77	106	109	102	111	101	97	111	Apr. 15	13
Crawford	58	80	92	68	62	81	72	64	105	....	78	90	85	....	....	78	42	55	50	65	50	90	83	99	99	92	75	81	Apr. 23	10
Dallas	78	72	99	70	81	....	49	55	68	75	94	81	77	....	55	87	63	40	70	71	67	98	100	103	103	94	94	101	Apr. 20	13
Davis	92	....	109	98	95	....	83	90	95	....	108	102	98	....	84	68	85	84	101	99	88	103	101	101	100	102	76	111	Apr. 15	14
Decatur	85	82	102	63	81	....	53	59	78	100	98	85	85	63	87	83	76	61	80	89	96	101	101	104	101	98	82	114	Apr. 6	15
Delaware	86	93	100	102	83	102	88	87	....	....	106	83	81	....	....	70	64	74	84	90	85	101	103	100	99	100	93	105	Apr. 25	10
Des Moines	71	90	104	102	96	90	81	82	80	....	100	87	68	12	56	79	96	75	103	112	88	101	111	102	85	87	84	111	Apr. 20	14
Dickinson	....	99	102	100	105	103	95	95	100	....	102	....	92	....	....	93	75	75	100	100	80	109	110	104	95	104	92	91	Apr. 20	17
Dubuque	83	84	88	96	95	90	86	98	....	....	90	....	90	....	....	75	74	66	78	81	69	89	95	98	85	85	75	88	Apr. 15	12
Emmet	....	100	100	95	....	95	95	100	....	....	100	....	135	....	....	100	75	100	....	....	100	100	92	100	100	90	70	112	Apr. 30	10
Fayette	88	103	108	108	93	102	90	88	102	....	99	105	87	....	....	89	78	96	95	93	97	105	102	105	102	102	78	111	Apr. 24	15
Floyd	65	100	93	104	90	96	84	72	88	110	84	100	77	....	85	74	42	74	82	87	69	102	98	101	96	100	84	102	Apr. 20	13
Franklin	..	102	105	99	88	96	71	72	88	....	98	100	101	....	100	99	71	65	89	92	81	103	102	102	97	102	96	92	Apr. 20	10
Fremont	73	75	101	63	82	80	44	44	100	100	73	100	94	10	80	85	47	41	58	66	72	98	93	99	95	100	88	98	Apr. 18	12
Greene	80	80	96	71	82	88	58	66	61	....	92	92	63	....	62	68	42	64	84	82	57	93	98	97	82	92	62	99	Apr. 2	12
Grundy	....	100	98	92	92	97	75	73	95	....	92	90	98	....	....	97	66	63	68	71	86	101	102	91	90	101	77	102	Apr. 1	12
Guthrie	83	76	94	72	70	95	50	62	97	....	88	90	82	80	95	68	63	54	73	83	86	96	101	99	96	97	78	104	Apr. 20	13
Hamilton	....	72	93	84	90	80	64	60	68	100	90	90	65	....	50	68	48	50	68	63	61	97	92	102	88	94	66	104	Apr. 20	13
Hancock	100	98	106	103	94	100	91	83	87	100	102	100	70	....	....	68	49	72	72	75	58	112	102	102	93	98	75	108	Apr. 21	12
Hardin	100	97	98	93	95	94	66	50	90	95	96	86	79	100	100	74	60	65	82	88	75	100	101	99	92	96	69	103	Apr. 17	12
Harrison	38	53	93	49	50	20	47	46	....	....	65	50	44	....	....	40	35	13	28	38	34	91	90	102	88	102	77	96	Apr. 24	14
Henry	99	93	105	94	102	....	99	101	90	....	103	94	97	10	55	93	101	83	81	100	91	105	101	95	87	98	69	106	Apr. 15	15
Howard	100	107	102	112	102	107	101	99	102	....	103	....	87	....	....	84	95	87	95	96	81	104	102	100	91	92	80	109	Apr. 20	15
Humboldt	82	93	101	86	94	89	72	61	90	100	100	....	61	....	25	74	47	53	53	51	62	104	102	100	83	102	90	105	Apr. 20	11
Ida	88	87	92	71	78	74	59	61	60	100	91	87	48	....	100	55	48	44	41	62	60	95	98	103	104	100	83	84	Apr. 20	11
Iowa	80	86	95	90	88	98	85	88	80	80	96	80	43	....	....	48	63	50	74	90	58	97	97	98	81	99	79	102	Apr. 20	12
Jackson	102	100	102	105	102	105	100	100	105	....	102	90	100	50	100	90	100	80	70	100	90	100	100	100	100	100	70	110	May 1	11
Jasper	81	85	100	87	85	73	64	71	95	80	97	89	70	....	80	64	58	58	82	97	92	101	101	100	92	98	87	104	Apr. 21	11
Jefferson	88	50	98	97	93	90	80	86	82	60	103	95	78	....	59	76	85	63	86	98	81	98	98	95	87	98	83	126	Apr. 20	10
Johnson	94	88	105	95	96	100	92	92	100	98	107	97	64	50	15	70	75	84	89	100	78	98	100	101	103	100	85	108	Apr. 12	10
Jones	..	102	108	106	105	113	88	91	....	....	99	....	75	....	....	58	100	89	100	114	90	98	100	104	109	100	76	110	Apr. 24	12
Keokuk	99	93	111	101	101	....	84	99	....	....	107	94	88	62	100	91	95	61	90	97	101	106	100	110	99	98	100	116	Apr. 20	15
Kossuth	110	75	112	110	....	60	120	100	....	....	110	....	....	....	....	100	....	120	100	....	....	120	70	100	115	100	20	110	May 1	10
Lee	81	100	99	102	92	100	83	88	97	80	109	96	68	2	66	71	96	82	88	100	70	98	98	100	96	97	70	107	Apr. 15	16
Linn	61	100	104	106	93	100	91	89	100	100	103	100	76	75	65	72	59	68	83	98	82	103	101	98	92	99	80	109	Apr. 18	11
Louisa	96	90	106	98	100	100	95	100	....	....	97	93	63	10	68	74	89	67	94	95	67	103	100	97	81	102	72	106	Apr. 20	11
Lucas	95	....	110	67	90	105	65	70	74	102	104	100	93	35	87	93	96	82	95	97	101	98	100	101	89	99	83	112	Apr. 10	14
Lyon	....	90	91	84	90	80	83	100	50	....	88	....	....	....	....	80	....	100	....	....	....	100	100	103	93	100	95	88	Apr. 24	11
Madison	81	81	101	68	82	75	57	61	75	85	96	82	87	100	78	85	70	46	74	100	80	98	99	103	90	93	67	104	Apr. 10	13
Mahaska	94	82	107	90	93	....	74	83	....	100	102	98	91	....	25	84	95	72	88	101	98	103	99	103	99	95	86	104	Apr. 12	11
Marion	93	86	106	86	91	92	59	83	95	100	102	91	84	....	55	81	71	66	81	82	90	99	93	96	78	98	78	111	Apr. 17	12
Marshall	95	86	100	83	86	87	66	66	75	....	92	98	57	....	75	61	58	66	81	79	84	98	98	101	103	100	88	106	Apr. 18	11
Mills	64	69	102	50	86	68	52	56	67	....	64	56	79	38	33	64	60	36	64	73	77	96	100	94	93	94	86	88	Apr. 20	12
Mitchell	45	93	95	103	74	100	92	80	95	....	95	....	89	....	40	62	78	60	78	85	88	96	95	101	91	96	79	101	Apr. 2	13
Monona	63	68	86	61	80	56	58	48	88	....	83	75	48	....	....	32	48	31	45	43	48	100	99	98	88	71	90	Apr. 25	12	
Monroe	75	80	106	78	83	....	69	78	85	....	113	91	96	50	90	101	93	89	86	101	88	109	97	102	86	99	85	114	Apr. 10	12
Montgomery	78	66	103	78	51	75	56	65	100	100	89	100	102	65	100	82	47	24	50	74	92	94	100	96	99	103	67	108	Apr. 17	14
Muscatine	87	..	96	102	91	62	83	86	....	....	92	86	74	....	....	63	71	68	79	94	72	100	92	91	87	89	71	107	Apr. 22	12
O'Brien	....	102	102	93	100	85	93	93	90	....	90	....	90	....	....	70	50	55	80	80	110	103	103	100	110	98	107	Apr. 15	18	
Osceola	....	95	107	101	107	102	104	90	90	....	104	....	98	....	....	88	102	90	98	97	100	108	101	102	109	99	89	105	Apr. 20	12
Page	70	85	98	60	72	....	32	42	....	....	78	80	90	....	....	115	75	46	55	65	78	90	95	100	88	95	100	88	Apr. 1	15
Palo Alto	....	80	91	78	88	80	74	78	....	....	98	....	80	....	....	96	55	81	63	60	....	117	100	104	90	106	80	87	Apr. 30	13
Plymouth	....	93	100	85	80	93	85	103	83	....	102	....	95	....	....	100	98	112	92	92	112	100	100	100	103	100	100	110	Apr. 28	12
Pocahontas	....	94	101	89	79	93	80	62	90	....	98	75	89	....	....	89	53	62	74	84	94	98	98	74	92	100	67	108	Apr. 18	12
Polk	80	87	100	78	75	60	53	63	90	100	94	91	76	....	100	92	72	46	79	90	95	96	98	93	95	92	82	101	Apr. 25	1
Pottawat'mie	68	68	89	50	72	72	42	58	50	....	72	60	54	40	45	42	35	30	46	63	44	94	100	97	81	97	82	88	Apr. 18	11
Poweshiek	94	90	99	97	99	100	72	82	100	....	104	90	76	....	....	74	52	78	82	101	90	99	101	98	87	98	66	103	Apr. 20	11
Ringgold	86	72	100	65	79	50	52	57	83	....	94	74	88	56	72	88	83	68	89	95	102	95	96	99	88	96	89	109	Apr. 10	16
Sac	25	79	102	79	93	85	66	69	87	....	96	....	79	....	....	84	65	58	65	70	80	98	98	101	84	102	75	101	Apr. 16	11
Scott	82	98	101	101	94	98	93	91	50	100	103	80	91	30	85	80	87	79	80	105	93	100	99	101	97	100	90	107	Apr. 15	12
Shelby	92	84	102	69	98	73	55	57	68	....	95	100	77	85	90	69	38	46	62	64	88	101	102	101	98	100	73	98	Apr. 20	9
Sioux	....	91	96	79	86	83	84	93	93	....	92	....	86	....	90	78	58	68	81	70	85	102	102	99	95	99	92	102	Apr. 20	13
Story	68	91	94	79	82	76	60	69	80	100	82	72	66	....	....	54	43	39	57	68	74	97	101	102	86	95	69	105	Apr. 20	15
Tama	50	98	106	91	76	97	69	75	80	....	100	....	91	....	50	92	46	35	42	98	85	103	94	93	98	94	66	102	Apr. 23	10
Taylor	70	65	106	54	84	....	49	59	85	....	98	100	92	90	80	82	72	57	74	96	90	96	97	100	91	90	83	109	Apr. 18	14
Union	....	80	105	64	95	....	56	62	100	....	100	85	82	....	70	95	92	85	75	96	99	103	100	101	100	92	94	89	108	Apr. 18	16
Van Buren	92	100	100	99	95	....	91	106	....	....	104	88	82	10	70	63	94	77	88	93	70	102	100	104	98	100	83	105	Apr. 7	11
Wapello	92	....	103	91	99	....	75	89	90	....	100	97	66	....	58	65	82	63	74	94	96	97	98	100	92	98	74	110	Apr. 10	13
Warren	86	84	107	76	93	85	64	72	90	90	99	91	96	50	83	99	90	67	85	96	94	100	99	101	93	77	81	110	Apr. 14	12
Washington	86	80	109	95	102	70	87	96	88	....	107	88	85	75	100	83	92	66	93	91	75	102	98	97	101	104	82	109	Apr. 16	12
Wayne	86	96	105	65	88	....	62	71	71	92	96	80	84	80	73	80	82	69	77	87	85	102	98	98	94	98	75	109	Apr. 10	16
Webster	....	85	102	94	86	80	80	78	90	100	100	100	80	....	....	88	52	70	73	69	93	102	100	102	71	102	88	101	Apr. 26	15
Winnebago	....	100	98	101	115	98	98	107	100	100	97	....	107	....	....	100	100	100	92	88	....	104	101	105	96	101	83	102	May 1	8
Winneshiek	93	104	100	107	94	103	98	97	....	....	100	....	84	....	100	78	87	88	96	102	95	101	101	102	90	98	85	103	Apr. 24	13
Woodbury	....	74	72	69	66	57	66	63	89	....	85	....	80	....	....	39	18	55	47	75	100	95	100	98	92	102	87	77	Apr. 20	12
Worth	60	107	100	105	90	103	94	82	100	....	96	100	90	....	....	95	65	91	100	105	....	102	98	98	105	98	84	102	Apr. 25	15
Wright	100	96	82	93	87	94	84	86	80	....	94	....	73	....	20	74	51	65	62	71	72	101	92	101	104	98	92	102	Apr. 22	12
Averages	81	89	101	85	88	87	74	77	87	94	96	88	....	37	74	79	69	66	78	86	81	100	99	100	94	98	80	103	.....	13

EDITORIAL NOTES.

"*Kentucky Weather and Crops*," is the title of a new and neatly printed monthly issue of the Kentucky Weather Service, edited by Frank Burke, U. S. Forecast Official and Director of the State service. The publication is deserving of liberal support.

***

Colman's Rural World, of St. Louis, says: "The MONTHLY REVIEW of the Iowa Weather and Crop Service has always something for a thinking man to read and to meditate upon. We can generally get a readable item from its pages of a sensible and serviceable character."

***

It has been determined by experiments that rivers infected with disease-producing bacteria undergo only a moderate degree of self-purification. We cannot safely assume that a polluted stream will purify itself.

***

Dry dirt is the best mulch for corn in a drouth.

***

It has been long known that frost plays some part in the production of maple sugar, that a peculiar sweetness is imparted to potatoes by freezing, and that persimmons do not lose their astringency and become sweet and delicious until after the first frost. A still more striking instance of chemical change due to freezing has been added by recent observation. The Canaigre roots of Mexico contain so much tannin that they are likely to supplant tree barks entirely for industrial purposes, yet after being frozen, it is stated, not the slightest trace of tannin is left. Just how the frost acts is a problem now to be solved.

***

Some one who has been looking up the statistics of business failures says: "Agriculture is safer than banking, manufacturing or railwaying. There is no farmer of good intelligence and good health living anywhere who cannot make a good living for himself and his family. That is as well as the majority of men are doing in any other pursuit. Only three per cent of men in other lines of business escape failure, and only three per cent of farmers fail. The man who owns a farm and sticks to it is certain of an eventual profit. There is practically no more land to be added to cultivation in the United States, but the demand for farm products will steadily increase. This must make better prices for products and better prices for the land which produces them."

***

The coming invention is an air-blast sweeper for household use. Here is a fruitful field for inventive genius.

***

England's wheat crop last year averaged 22½ bushels per acre—a very poor crop for that country.

***

Vastly more damage is done to corn by weeds and grass than by frost or drouth. Clean culture and dry dirt mulch will insure a good crop in the dryest season ever known in Iowa.

The macadamizing of a piece of road in Ohio increased the value of the adjoining farms $4.50 an acre, while the cost was less than $1.00 an acre. Some one ought to go all through the country preaching the gospel of good roads.—*American Cultivator*.

***

O Weather-man! Diurnal pest!
What hideous malice swells your breast,
That you should cram a thousand climes
Into one country? Sure the times
Are out of joint, and I'll be blest
If I know whether it were best
To wear an ulster or no vest,
Since you've begun your thermal crimes,
O Weather-man!
—*Southern Almanac*.

***

The people of Iowa who have the time and means to seek recreation and cool resorts during the heated term, should bear in mind the fact that the lake region of northwestern Iowa possesses all the requisites for a most enjoyable summer outing. There you will find altitude, refreshing breezes, inviting shade, pure water, good fishing and the best of society. Iowa people should not go abroad to seek summer resorts until they have tested the qualities of their own.

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The Homestead says: "The corn crop of Iowa and Missouri may this year show the largest acreage on record, the increase being due to the plowing up of permanent pastures, owing to a scarcity of cattle."

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Not a few careful observers of the signs of the times predict that before the new century dawns corn will reach a higher price than wheat, which can be produced the round world over. Already the money value of this distinctively American crop is nearly double that of the wheat crop of the country. As a food it is fast gaining high favor among the people of the old world. It is easily raised and does not exhaust the soil, and has been the surest and greatest source of wealth for this country. The corn belt is a limited one, considering our immense area. Land within its limits has never shown any permanent depreciation. In the course of events farm values in this corn belt must range higher and prove more profitable than mines of mineral wealth.—*Dubuque Globe*.

***

There has been a change of weather prophets in Chicago, and an *Inter-Ocean* scribe serves it up in rhyme, as follows:

Good-by Frankenfeld!
Thou once was warmly held
In our city's veneration;
Thy toilsome task is done,
Thy resting day has come,
Lieutenant Frankenfeld.
In thy departure pray thee take
The stormy spirit from the lake;
Confine it in St. Louis crust—
It may liven up its dust.
We want no more of weather balky,
Yet now comes Moore from Milwaukee.

A study of the census tables has shown that the distribution of population in the United States is regulated by the abundance or scarcity of rain. Three-fourths of the people have their homes in those regions where the annual rainfall ranges from thirty to forty inches.

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Reports from Great Britain state that the month of April was unusually favorable to agricultural interests. From Europe generally crop reports are quite flattering.

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There are more thunderstorms in Europe, according to the president of the French Meteorological society, than in equatorial regions. They occur in some parts of France every day of the year, and in six or seven months of 1892, as many as 328 were counted. But in Sumatra where there are storms during the six months of the southeast monsoon, thunder is never heard; and Peru has only one or two thunderstorms in a century, that of 1877 having been the only one since 1803.

***

The annual meeting of the Association of State Weather Services is to be held at Brooklyn, N.Y., in connection with the meeting of the American Association for the Advancement of Science, beginning August 17, 1894. All voluntary observers of the service are honorary members of this association, and are entitled to all its privileges. The railroads will give special rates to members. Particulars can be obtained by addressing this office.

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What this country needs is a well-adjusted and effective rain distributor. There's millions in it for the inventor who will get up a device that will do the business; and it is no more difficult than it is to produce rainfall by chemical hocus pocus. There was an abundance of rain in May, but it slopped over on the Pacific coast, up in Oregon and Washington, drowned out portions of Colorado, and gave some of the eastern states a tremendous drenching, whilst Iowa went dry. The people of the whole country look to Iowa for breadstuffs and things to eat, but we shall be obliged to allow them to go hungry if all the waters of the heavens are thus wasted in slushing their barren old rocks and hillsides. We want a better distribution of moisture. Let's get up a memorial to congress to remedy the matter. Every wrong should be righted by legislation.

***

The U. S. Weather Bureau has issued a paper by Alex McAdie, upon "Protection from Lightning," giving valuable information to the people in regard to the character of lightning flashes, the danger to be apprehended from this source, and the best methods of protection. Many practical suggestions are given regarding the erection and use of lightning rods, and the paper also contains interesting statistics of actual losses, and graphic illustrations of different forms of lightning flashes. According to the figures given by Mr. McAdie, there occurred in 1892 in this country, 251 deaths by lightning; in 1893 there were 209 fatalities from the same cause. The average number of persons killed yearly by lightning is 196, and the greater number of fatalities occurred in June, July and August. In the eight years ending in 1892, there were 3,516 fires in the United States caused by lightning, the total loss amounting to $12,663,835. Barns, stables and granaries suffered most largely. Electric light stations, telegraph and telephone offices enjoyed a comparative immunity from damaging strokes. With regard to trees the oak is most frequently struck. The risk in the country is five times greater than in the city. Mr. McAdie states that it is not judicious to stand under trees, in the doorway of barns, close to cattle or near chimneys and fireplaces; and this it may be said, is a scientific justification of the actions of probably five persons out of six when a storm is prevailing.

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Corn is Iowa's sheet anchor, and it's not going to fail this year. Make a note of that and watch the outcome.

THE RAINMAKERS AT WORK.

The rainmakers have been industriously plying their trade in Kansas and Nebraska since the opening of the crop season, and it is reported that they have at least succeeded in convincing a good many people that they possess the ability to draw moisture from the most arid skies under the sun. The Kansas City *Star* of recent date devoted a column to this subject, arriving at the conclusion that "the rainmaker seems to have a peculiar faculty for commencing his experiments just about the time a rain is due, and there have been many remarkable coincidents due to this fact, or else many remarkably successful experiments at rainmaking. The faith of the western people in the processes is based on the seeming success of them."

The Rock Island Railroad company, the *Star* says, maintains a rainmaking department, for which special cars have been fitted up. The chief assistant rainmaker in a recent interview said: "We do not claim to be absolutely able to produce rain. We merely assist nature in the work. At times a certain element is lacking in the atmosphere, and by the use of gases and electricity we believe we are able to furnish what is lacking. What that element is we decline to say."

We can guess the name of the lacking element of the atmosphere to which this rainmaker so secretively refers; it's just plain, straight water—only that and nothing more. When the air is heavily laden or saturated with water—in form of vapor or humidity—it will almost rain itself, without any teasing; the slightest fall in temperature will press out a portion of the vapory surplus. Now, if the rainmakers are able to supply that element in sufficient quantity, and then can suddenly squeeze the bag, the heavens will give down rain every time. The question is, can they do it, and have they done it?

During the severest period of the recent drouth the instruments at the Central Station of this service showed, at the 7 P. M. observations, for fifteen consecutive days, an average mean relative humidity of only 25 per cent—or a range of from 17 to 37 per cent. To squeeze rain out of such atmosphere on those days would require a sudden fall of temperature to 37 degrees—almost to the frost line. The question is, can that be done by a little box

of chemicals discharged in the air in a vapory form? We doubt and wait.

Like shrewd politicians the rainmakers "claim everything," and the season has apparently favored their claims. Kansas and Nebraska have had some fine showers within the last three weeks, while Iowa went dry. Reversing the general rule those States have for a brief period had more rainfall than Iowa and Illinois. But portions of Colorado have at the same time been deluged with greater quantities than Kansas and Nebraska; and the North Pacific States have been nearly drowned out. Evaporation and precipitation must be equal. When there is an excess of rainfall in one section there must be a corresponding deficiency in another section. There were phenomenal downpours in May in the Atlantic States, on the Pacific and among the Rocky mountain districts; so a portionof the mid-continent region went dry. No more water can come down in form of rain than goes up in vapor.

And if it can be proven that the Rock Island rainmakers have actually drawn away moisture from the vapor-laden currents, for the benefit of Kansas and Nebraska to the detriment of Iowa, then we may in equity stop the business by injunction proceedings. They have no more right to interfere with the natural course of the humid streams of atmosphere than they have to turn the course of the Missouri or the Platte.

Down in Kansas, it is said, while the operators were at work, there occurred a destructive rain and hail storm; and now the people whose property was injured are about to bring suits against the Rock Island Company for damages. On the basis of the theory that the company's agents produced the disturbance the people have a just cause of action. But there's the rub. If the cases come to trial there will be no trouble in procuring a great cloud of witnesses, scientific experts at that, to swear that the so-called rainmakers are in nowise responsible.

A SHORT HAY CROP.

It is now definitely certain that the early hay crop will be short—probably not exceeding 50 per cent of an average crop. Clover and timothy meadows have suffered from the combined effects of a droughty autumn, winter killing, zero temperature the last of March following a period of unusual warmth, and the unprecedented drouth in May. In many portions of the State on the first of June the meadows were brown and dry enough to burn, the fields presenting the appearance of autumn rather than of spring time. Pastures readily revive with a copious rainfall, but after such a set back the early hay crop is past recovery.

Under the circumstances farmers will be obliged to make the most of all their resources to secure forage for their stock. By cutting meadows early a fair second crop of hay may be secured if the balance of the season is favorable. The supply of forage may be greatly increased by sowing millet and corn in liberal quantities. And this will be a good year to test the value of corn fodder as a substitute for hay. It is stated on reliable authority that three acres of corn fodder well secured, is worth as much as two acres of good hay, and this is probably a correct estimate of their relative nutritive value. This gives assurance that with a fair crop of corn the live stock of Iowa need not suffer for want of forage if not a ton of timothy or clover is secured. There has never been anything near a total failure of corn in this State, and the farmers have never yet made use of the entire crop. The shortening of the hay crop may result in great profit to the farmers, if it shall enforce a lesson of economy in this line. With our immense acreage of corn we may profitably dispense with a considerable portion of the area now devoted to growing timothy and clover, using as a substitute the fodder which has heretofore been practically wasted.

UTILIZE THE RAINFALL.

There are ten or fifteen million acres of land in western Kansas and Nebraska, and as much more in eastern Colorado which only requires irrigation in order to become the most productive and richest portion of the United States. But it is useless to talk about irrigation from the few streams in that part of the country.

There is just one and only one practicable way in which the water can be obtained for irrigating these now dry and barren plains. It is not by sinking artesian wells, although that might help. But nature now furnishes a bountiful supply which is far more cheaply and easily obtainable. It is the storm waters from the skies, of which even ten or fifteen inches now falls each year, which is permitted to run off without benefiting anybody. It is only needed to impound this. The face of the country everywhere is very admirably adapted to that method. There are slopes and hills and valleys over the whole country in which this now waste water can be stored. Reservoirs can everywhere be built at small cost, in which the waters from the heavens could be kept, and from which it could be distributed as it is needed.

The time is not distant when this will be done, and when it is done that entire region will blossom as the rose. Those who fifty years hence shall look upon that now barren and forbidding region will behold as fair and productive a country as the sun anywhere shines upon—a country shaded by clumps of trees alternating with green fields, in which pleasant homes and schools and churches will meet the eye in every direction, and in whose fair and fertile fields cattle, horses, sheep and hogs will subsist, and the crops of which will suffice for the subsistence of a dense population.—*Council Bluffs Nonpareil.*

The foregoing article contains a wise suggestion to the farmers of Iowa as well as the people of the arid plains. The value of many farms would be enhanced by utilizing depressions or sloughs, wherein reservoirs may be cheaply constructed for the storage of surplus storm waters. The water supply could be materially increased, and in many cases made permanent, by conveying to these reservoirs the flow from the tile drains of adjacent fields. These little lakes would beautify many an unsightly place, and in some instances they might be stocked with fish to serve an additional purpose of utility.

There are drouthy periods in nearly every season, when wells run low and stock water becomes scarce; and at such times even the tepid water of a slough is better than none.

A stock well sunk in close proximity to a reservoir would be likely to afford a permanent supply of pure water, and by wind-power it could be pumped to distant fields. And the time is not distant when it will be found

profitable to hoard up surplus storm waters, to be pumped out upon the fields for the purpose of irrigation.

Under the system of intensive farming, which will be necessitated by our continually increasing population, irrigation will be resorted to even in Iowa, and the farm reservoir will furnish a large part of the needed supply. The waste forces of nature in form of the winds, can be made to do the work of distribution.

ECONOMIC VALUE OF FORESTS.

A text book on agriculture used in the schools of Ontario briefly specifies the uses of forests as follows:

1. They are sources of timber, lumber and fuel.

2. They modify the climate during the heat of summer by making the days cooler and the nights warmer; retard the evaporation of water from the soil, and, without increasing the aggregate rainfall, cause its more even distribution throughout the year.

3. They affect the salubrity of climate not only by causing a more even temperature and a more even rainfall, but also by absorbing carbonic acid gas and exhaling oxygen during the hours of daylight.

4. The presence of forests influences the steadiness of the flow of water in streams and rivers, thus tending to prevent destructive floods and spring freshets.

5. In cold climates forests are of immense service as a protection against cold winds, which freeze out winter crops in cold places and cause snow to accumulate in drifts in the highway.

ELECTRICITY IN 1900.

Responding to an invitation from the editor of the Baltimore *Sun*, the editors of four electrical publications gave their ideas as to the probable development of electricity in its application to the practical utilities of the world, and the wonderful changes that may be witnessed by the dawn of the next century. The editor of the *Electrical World* says:

"We can expect no great improvements in dynamos and motors, as they now return in electricity as high as 97 per cent of the energy supplied to them. The arc lamp is practically perfect electrically, and while notable improvements may be made in the present form of the incandescent lamp, nothing startling can be expected. Electric railway traction will undoubtedly supersede all other methods for urban use and, by the extension of networks in the country, promises to largely revolutionize rural life; its application, however, to long trunk lines seems improbable. The electrical transmission of power will receive enormous extensions and probably entirely take the place of steam power within a radius of several hundred miles of water power and in the vicinity of coal fields, whence the energy of coal will be distributed by means of the electrical current instead of the coal itself being transported. The electric light will entirely supersede all other kinds of illumination in cities, towns, and thickly settled rural districts, and electric motors will gradually enter into all operations requiring power, and more and more narrow the field of the steam engine, if with the gas engine as an ally it does not drive it out entirely. Telephoning across the Atlantic is a probability and seeing by electricity a possibility.

The editor of the *Electrical Review* also believes in the sure advent of the transatlantic telephone, the farther development of the transmission of electric power and especially an elaboration of the domestic use of electricity. On this last point he says: "Electric heating is now an important element in the rapidly extending railway business, replacing the disagreeable and dangerous car stove, and is advancing into the domain of the coal furnace and gas range, bringing cleanliness, convenience, and economy with it. When fully perfected and understood, the electric heater will be one of the greatest boons that the electrical engineer has given us. Every housewife will rise up and call him blessed, and every husband will bless him and not rise up! He can lie abed and increase or originate heat in room and kitchen by simply turning a switch or pressing a button. Even this effort may be dispensed with and a clockwork attachment press the button automatically."

The editor of the *Electrical Age* coincides with this prophetic view of the household run by electricity. This is his view of what we will have by the year 1900: "I expect to see our homes, offices, stores, etc., heated by electricity. This system of heating is entirely practicable, the only question involved being the all-important one, cost. It probably will be made popular by supplying electricity from large central stations through street mains, connecting the premises therewith. Electricity may then be used for cooking and doing what mechanical work may be necessary about the house, store, or factory. It can be made to perform all of these duties by simply turning a little handle or pushing a button. Electricity will be used to accomplish a thousand and one different things to save us labor and in directions little dreamed of at present. New things and applications are being constantly developed; it only needs more popular familiarity with them to find a wider use for them."

The editor of *Electric Power* joins all these and goes even further. Among the items of his prophetic vision are some bits of domestic beatitude like the following:

"In 1900 we shall probably have brought down the cost of current and of utensils to such a degree as to allow even people in moderate circumstances to use the cleanly current instead of the coal or gas stove. Then will the millennium of the servant girl have broken into dawn. The overhead or trolley system will very probably be superseded by a system not more obtrusive than the cable on Broadway—a conduit system. The cars running underground will be propelled by electricity.

"In six years we can look for the supersession of the incandescent lamp as it is at present by a new lamp evolved along the lines sketched out by Nikola Tesla, whose brilliant discoveries have recently been fully enumerated by our esteemed confrere, Mr. T. Cummerford Martin. The new lamp will probably be without filament, but will glow by the luster of a high frequency current properly employed. There is even a possibility of the present bulb-shaped lamp disappearing, giving way to a long continuous tube of glass hidden away behind

crevices and casting a soft light upon the ceiling and thence down upon the floor. The disinfection of the city will probably be effected by the agency of electricity. The canal boats will come down to the wharves propelled by electricity. The streets will perhaps be cleaned by an electrically driven brush, and a mighty exhaust fan in the city hall, driven by a dynamo, may serve to purify it."

MAY WEATHER REPORT.

The mean temperature of May, 1894, 61.1°, was about 1.4° above the normal. But it was a month of phenomenal extremes of temperature, the general range for the State being from 90° to below the frost line, on the 19th and 20th, causing extensive damage to gardens, small fruit, and field crops in some localities. It was altogether the most damaging frost ever known in Iowa in May, at that stage of crop growth. Lighter frosts, quite general, occurred on the 27th, 28th and 30th. The greater part of the month, however, was warm and bright.

The average rainfall for the State, as shown by the records of seventy-seven stations, was 1.87 inches--2.28 inches below the normal. It was the dryest May ever known in Iowa since records have been extensively kept. Only a few localities reported the normal amount. In the last half of the month all districts suffered the effects of this unprecedented spring drouth.

The following table gives, as a basis of comparison, the mean temperature and average precipitation at the stations named for the month of May, for the years from 1872 to 1894, inclusive:

YEARS.	MEAN TEMPERATURE, DEGREES.						PRECIPITATION, INCHES.					
	Des Moines.	Davenport.	Dubuque.	Keokuk.	Omaha.	Sioux City.	Des Moines.	Davenport.	Dubuque.	Keokuk.	Omaha.	Sioux City.
1872	....	....	....	64	61	....	.....	4.46	.....	3.70	6.35	.....
1873	....	59	....	61	59	....	.....	6.37	.....	3.42	5.50	.....
1874	....	64	68	67	66	....	....	3.45	1.68	1.65	1.24	.....
1875	....	60	60	62	63	....	.....	2.01	3.62	6.70	4.25	.....
1876	....	62	61	63	63	....	.....	6.70	3.96	5.28	2.07	.....
1877	....	62	62	62	60	....	....	2.82	3.84	5.55	8.62	.....
1878	....	58	56	59	58	....	..	5.14	4.61	3.47	5.77	.....
1879	64	64	63	65	67	..	4 74	5.83	2.94	2.27	5 53	.....
1880	68	67	67	69	69	..	5.84	5.09	3.72	5.92	3.40	.....
1881	67	69	69	70	68	....	3.82	1.34	2.20	1.35	7.94	.....
1882	55	56	54	57	57	....	8.53	5.49	4.16	7.11	4.91	.....
1883	56	57	55	60	57	....	9.76	5.46	7.13	4.37	11.29	.....
1884	60	61	60	62	62	....	4.34	3.79	4.88	3.16	1.45	.....
1885	59	58	58	61	60	....	1.70	1.94	2.62	2.59	4.48	.....
1886	64	62	62	65	65	....	3.71	3.73	4.17	4.49	4.58	.....
1887	65	69	66	67	66	....	2.31	1.76	2.53	2.54	1.39	.....
1888	54	55	54	58	56	....	7.84	9.23	5.84	5.06	4.36	.....
1889	60	59	59	62	62	..	4.84	6 34	4.00	5.72	2.67	.....
1890	58	58	56	60	60	58	3.60	4.23	5.36	3.34	2.72	2.29
1891	58	58	58	60	59	59	3.29	2 74	2.54	2.56	4.94	2.41
1892	55	56	55	58	54	52	8.77	8.84	9.18	6.34	8.43	8.56
1893	57	58	57	60	59	57	2 84	2.67	3.06	4.56	3 84	3.17
1894	62	61	62	63	65	62	1.41	1.93	1.75	3 86	0.61	1.91
Means	60	60	60	62	62	58	4.80	4.49	4.17	4.12	4.51	3.67

SUMMARY OF WEATHER CONDITIONS.

BAROMETER—Mean pressure for the month 29.94 inches; highest observed, 30.39 inches at Davenport on the 11th. Lowest observed, 29.34 inches at Sioux City on the 16th. Range for the month 1.05 inches.

TEMPERATURE—Monthly mean as determined from 70 voluntary observers' reports, 61.1°; highest monthly mean, 66.4° at Glenwood and Fort Madison. Lowest monthly mean, 58.0°, at Hopkinton. The highest temperature reported was 96°, at Logan, on the 14th. The lowest temperature reported was 22° (?) at Atlantic, on the 19th. Average daily maximum, 73.9°; average daily minimum, 48.1°; average monthly maximum, 90°; average monthly minimum, 34.0°. Greatest monthly range, 69°, at Logan and Atlantic. Least monthly range, 37°, at Mt. Pleasant. Total range for the State, 74°.

PRECIPITATION—Average for the State as determined by 77 voluntary observer's reports, 1.87 inches. The largest amount reported was 4.77 inches, at Clinton. The smallest amount reported was 0.33 inches, at Rock Rapids. The average number of days on which .01 inch or more of rain fell was 6; average number of cloudy days, 4; partly cloudy days, 10; clear days, 17,

FROSTS; KILLING—General throughout the State on the 19th. and in north central on the 20th. Considerable damage reported to gardens.

FROSTS; LIGHT—General throughout the State on the 2nd, 11th, 20th, 27th, 28th and 30th.

HAIL—Algona, 4th; Cresco, 5th; Cedar Rapids, 5th; Davenport, 1st; Elkader, 5th; Ft. Madison, 5th; Emmetsburg, 5th; Grundy Center, 5th; Iowa City, 5th; Newton, 5th; Ovid, 1st; Seymour, 6th; Sibley, 4th; West Bend, 2nd; Washington, 1st; Webster City, 5th; Winterset, 1st and 5th.

THUNDERSTORMS—In scattered localities, on 1st, 3rd, 4th, 5th, 10th, 16th, 17th, 25th and 26th.

AURORA—At Alta, 28th and 30th; Cresco, 30th; Delaware, 28th; Ovid, 26th, 27th and 30th; Sutherland, 23rd.

METEOR—Alta, 9:45 P. M., of the 13th.

A severe storm in Monroe, Appanoose and Davis counties, on the 5th. See Observers' Notes for particulars of the storm.

HALO—Lunar, Glenwood on the 14th; Des Moines, 14th, 15th and 28th.

SOLAR HALOS—Des Moines, 12th, 15th, 28th and 29th.

SEVERE LOCAL STORMS.

The most destructive storms of the month, in Iowa occurred on the 5th inst., the damaging effects being noted at a number of points in the central and southern belt of counties.

On the evening of the 5th a small but vigorous tornado passed through the northern part of Appanoose county, continuing its work a short distance into Davis county. It was first observed about 2½ miles south of Iconium, and it traveresed a narrow belt in a southeasterly direction to a point about five miles north and east of Bloomfield, in Davis county.

Prof. H. E. Reister, of Centerville, writes: "It started near Iconium and traveled a little south of east as far as Unionville. It was a terrific storm and tore everything in its way. Near Maine it struck a large church and carried the building and foundation away, leaving scarcely a stone. It blew three cars of coal twenty-five yards from the track. One farmer's house and barn were blown away. A horse in the barn was carried forty rods

and left uninjured. Chickens were killed and completely stripped of feathers. The path of the storm was about one hundred yards wide, and can be traced easily, as even the bark from trees and hedges is torn off. The wind here (at Centerville) was from the S. W. during the storm, and blowing pretty hard. There was little lightning, but it was very sharp."

Near Maine it struck a house and killed Mrs. William M. McDaniel. The storm is described by various people as having a whirling motion, revolving counter-clockwise. The roar of the storm was heard by numerous persons two to four miles distant. Some hail was observed in advance of the tornado. Hard rain began a few minutes after its passage. There was but little lightning, and mostly after the windstorm passed. The distance traversed was about twenty to thirty miles, and the damage is estimated at $30,000—probably exaggerated. A special from Ottumwa, says: "Word is received here from Belknap that a destructive tornado swept over a portion of Davis county Saturday evening. About seven o'clock two heavy clouds met in the Fox river valley, and started to move rapidly in a southeasterly direction along the course of the stream. It soon commenced a whirling motion and assumed the dreadful funnel shape. The cloud was plainly visible from this place, and was watched with a great deal of interest and no little apprehension. The house of Henry Baily, west of Darkville, was the first residence in its path, and Mr. Baily's story and a half house was utterly demolished, scarcely two boards being left together. Mrs. Baily was severely, though it is now hoped not fatally, injured in the wreck, and their 6-year-old boy was so badly cut across the face that one eye had to be entirely removed. A 14-months-old infant was picked up by the wind and carried clear over a barn. It was then dropped quietly onto the earth, where it was found unhurt, and with but one little scratch on its body. Another and larger child was blown out into a field, and was met by its parents coming back towards where the house had been, after the storm was over. The houses of a man named Clark and one named Morris were blown from their foundations, and the large barn of P. C. Martin, near Bloomfield, was unroofed. The storm cut a swath an eighth of a mile wide through the heavy timber, tearing trees two feet in diameter up by the roots. It is probable that the timber broke the force of the storm, however, as little damage was done after leaving it."

On the afternoon of May 5th, a hail and wind storm passed through the central belt of counties, from Poweshiek to Johnson. At Brooklyn the damage by hail and wind was quite heavy, and for fifty miles eastward there was a belt of disturbance three to five miles in width, with considerable damage to window glass, roofs, fruit trees and crops. The storm wrought the greatest destruction at Iowa City. Prof. A. L. Arner, of the State University, writes: "This section was visited this afternoon (May 5th) by a most disastrous hail storm, occurring about 5 P. M. It began as a thunder storm coming from due west, the rain beginning about 4.30 P. M. The clouds were densely black. After a time hail began to fall, in size about half an inch in diameter. Suddenly a downpour began which will ever be remembered in eastern Iowa. I measured hailstones which were two inches in diameter. One was two and one-half inches in its longest dimension. The damage in this city will reach many thousands of dollars. Besides the destruction of window glass and plate glass fronts, many tin roofs were riddled with holes, thus exposing valuable goods to damage by rain. The total loss at Iowa City has been variously estimated, from $50,000 to $75,000.

On the same evening Clinton was visited by a very severe rain and wind storm, accompanied by a little hail.

ATMOSPHERIC PRESSURE.

STATIONS.	Mean reduced barometer.	EXTREMES. Highest reduced barometer.	Date.	Lowest reduced barometer.	Date.
Cedar Rapids	29.92	30.25	11	29.44	5
Clarinda	29.98	30.37	11	29.45	16
Cresco	.....	30.34	11	29.46	5
Davenport	29.94	30.39	11	29.43	5
Des Moines	29.95	30.36	11	29.48	16
Dubuque	29.93	30.37	11	29.42	5
Keokuk	29.95	30 38	11	29.51	5
Omaha (Neb)	29.96	30.37	19	29.44	16
Sioux City	29.93	30.34	19	29.34	16
Means	29.94	30.39	11	29.34	16

WIND MOVEMENT.

STATIONS.	Number of miles.	Maximum velocity.	Direction.	Date.
Davenport	6,790	40	SW	6
Des Moines	6,709	34	SE	1
Dubuque	5,017	31	NW	6
Keokuk	5,613	36	SE	1
La Crosse (Wis)	6,701	36	W	7
Omaha (Neb)	7,220	30	W	17
Sioux City	9,783	42	S	11

OBSERVERS' NOTES.

Clinton.—DR. LUKE ROBERTS: The mean temperature for May, 1894, was 60.9°. On the 16th the maximum was 91°; on the 19th the minimum was 37°—only three days intervening between these extremes.

The average May temperature for the last 16 years was 59.3°, therefore, May, 1894, was 1.6° in excess of normal. The maximum had only been equaled twice in the last 13 Mays, viz: 1887 and 1890. The minimum was 4.4° above average. The warmest day was the 16th, with a mean of 80.7°, or 7.5° above May warmest days. The coldest day was the 18th (only two days later) which gave a mean of 47.7°, or 3.8° higher than the average May cold days.

The rainfall was 4.77 inches; this is about normal and so also was the number of storm days, which was 12. The principal storm of the month was that of the 5th, when the precipitation amounted to 2.5 inches. It all came down between 5:25 and 10 P. M. From 6:20 to 6:30 o'clock the downpour was very great, with a little hail interspersed. The rush of water in its haste to reach the river moved much dirt and stone to the discomfort of those

who had loads of it to remove after the storm. This storm came down with such a rush that a large per cent of it found its way to the streams so that the land was not greatly enriched by it. The rest of the storms were light, and all the water was taken up by the soil. At the close of the month rain is much needed for the crop service.

The movement of the wind was 4,360 miles, an excess of 500 miles above May average. The maximum velocity was 26 miles an hour, and the prevailing direction n. e.—s. w. s w. and n. w. nearly the same. On the 18th a twisting intermittent wind prevailed, breaking many small limbs and twigs and scattering leaves profusely. There was but little thunder and lightning and none damaging so far as heard from.

On the morning of the 11th there was a light frost, and on the 19th frost was sufficiently severe to injure corn, tomato plants, cucumbers, colens, etc. Corn was probably retarded ten days.

The river reached its highest for the season on the 31st. It was then fourteen feet and one inch and at a stand.

Hopkinton.—THEO. MARKS: May maximum temperature for 40 years, 91°—1856—minimum, 25°, in 1885; highest mean temperature, 68°, in 1870; lowest mean temperature, 52°, in 1860. Greatest amount of rainfall in May, 8.68 inches, in 1892; least amount, .76 inch, in 1874. Normal, 3.85 inches.

Amana.—CONRADT SCHADT: Hail storm of the 5th lasted for seven minutes. Many windows were broken. Some of the hail stones measured 1⅛ inches by ¼ inch thick. Not much damage done to crops. Potatoes and corn were damaged by the frost of the 19th, 28th and 31st, on low ground.

Clarinda.—A. S. VANSANDT: A cool, dry month. The dryest month on record here.

College Springs.—A. A. BERRY: Very dry and crops suffering. Hay will not make one-third crop. Pastures burned up. Corn is not suffering much and is good stand, well advanced for the season. Frost on night of 19th did much damage to low land vegetation.

Grinnell.—PROF. S. J. BUCK: A violent hail storm on the afternoon of the 5th, between 3 and 4 o'clock. Hail stones were from one-half to one and a half inches in diameter.

Williams.—M. L. FULLER: The dryest May on record since 1887

BELATED REPORTS.

FAYETTE, for *April*, 1894. Mean temperature, 50.7°; maximum temperature, 80°, on the 29th; minimum temperature, 27°, on the 1st and 6th. Total rain, 3.78 inches; largest amount in any one day, 1.15 inches, on the 17th. Prevailing wind, S. E. Number of clear days, 8; partly cloudy, 6; cloudy, 16; rain fell on 12 days; hail on 2 and sleet on 2; thunder storms, 6.

WEST BEND—*April*, 1894. Mean temperature, 48.3°; highest temperature observed, 77°, on the 18th; lowest temperature observed, 20°, on the 1st. Total rain, 3.17 inches; rain fell on 7 days.

INDEPENDENCE—*April*, 1894. Mean temperature, 56.2°; maximum temperature, 83°, on the 29th; lowest temperature, 32°, on the 2nd. Total rainfall, 3.31 inches. Rain fell on 7 days; clear days, 12; part cloudy, 5; cloudy, 13; prevailing wind, south; frost on 2nd.

JULY'S PAST WEATHER RECORD.

DES MOINES—15 YEARS' RECORD.

TEMPERATURE—Mean or normal, 75°. The warmest July was that of 1886, with an average of 80°. The coldest July was that of 1891, with an average of 69°. The highest temperature during any July was 104.2, on July 6, 1886. The lowest temperature during any July was 49°, on July 9, 1891.

PRECIPITATION—Average for the month, 3.77 inches. Average number of days with .01 of an inch or more, 10. The greatest monthly precipitation was 8.64 inches, in 1892. The least monthly precipitation was 0.27 inches, in 1886. The greatest amount of precipitation recorded in any 24 consecutive hours, was 2.31 inches, on July 9, 1881.

CLOUDS AND WEATHER—Average number of clear days, 11. Average number of partly cloudy days, 14. Average number of cloudy days, 6.

WIND—The prevailing winds have been from the southwest. The highest velocity of the wind during any July was 40 miles, on July 16th and 10th, 1883 and 1891, from southeast and east.

DAVENPORT—23 YEARS' RECORD.

TEMPERATURE—Mean or normal, 75°. The warmest July was that of 1887, with an average of 78°. The coldest July was that of 1891, with an average of 69°. The highest temperature during any July, was 99°, on the 12th, 1887. The lowest temperature during any July, was 49°, on the 9th, 1891.

PRECIPITATION—Average for the month, 3.83 inches. Average number of days with .01 of an inch or more, 9. The greatest monthly precipitation was 9.36 inches in 1875. The least monthly precipitation was 0.43 inches, in 1886. The greatest amount of precipitation recorded in any 24 consecutive hours, was 5.18 inches, on the 13th and 14th, 1889.

CLOUDS AND WEATHER—Average number of clear days, 11. Average number of partly cloudy days, 15. Average number of cloudy days, 5.

WIND — The prevailing winds have been from the southwest. The highest velocity of the wind during any July, was 52 miles, on the 9th, 1879.

DUBUQUE—20 YEARS' RECORD.

TEMPERATURE—Mean or normal, 74°. The warmest July was that of 1887, with an average of 78°. The coldest July was that of 1882, with an average of of 68°. The highest temperature during any July was 101°, on July 5, 1874. The lowest temperature during any July was 48°, on July 1, 1892.

PRECIPITATION—Average for the month, 4.53 inches. Average number of days with .01 of an inch or more, 10. The greatest monthly precipitation was 10.53 inches, in 1881. The least monthly precipitation was .89 inches, in 1886. The greatest amount of precipitation recorded in any 24 consecutive hours was 4 55 inches, on July 4 and 5, 1876.

CLOUDS AND WEATHER—Average number of clear

days, 11. Average number of partly cloudy days, 14. Average number of cloudy days, 6.

WIND—The prevailing winds have been from the south. The highest velocity of the wind during any July was 36 miles on July 26, 1874.

KEOKUK—22 YEARS' RECORD.

TEMPERATURE—Mean or normal, 77°. The warmest July was that of 1878, with an average of 81°. The coldest July was that of 1891, with an average of 71°. The highest temperature during any July was 104°, on 14th, 1890. The lowest temperature during any July was 52°, on 9th, 1891.

PRECIPITATION—Average for the month, 4.39 inches. Average number of days with .01 of an inch or more, 6. The greatest monthly precipitation was 12.70 inches, in 1875. The least monthly precipitation was 0.65 inches, in 1886. The greatest amount of precipitation recorded in any 24 consecutive hours was 5.06 inches, on July 4, 1876.

CLOUDS AND WEATHER—Average number of clear days, 10. Average number of partly cloudy days, 15. Average number of cloudy days, 6.

WIND—The prevailing winds have been from the south. The highest velocity of the wind during any July was 42 miles, on 3d, 1879, from west.

SIOUX CITY—5 YEARS' RECORD.

TEMPERATURE—Mean or normal, 74°. The warmest July was that of 1889, with an average of 76°. The coldest July was that of 1891, with an average of 69°. The highest temperature during any July was 104°, on 13th, 1890. The lowest temperature during any July was 47°, on 8th, 1891.

PRECIPITATION—Average for the month, 3.32 inches. Average number of days with .01 of an inch or more, 10. The greatest monthly precipitation was 5.77 inches, in 1891. The least monthly precipitation was 2.29 inches, in 1893. The greatest amount of precipitatien recorded in any 24 consecutive hours was 2.14 inches, on 6th and 7th, 1891.

CLOUDS AND WEATHER—Average number of clear days, 14. Average number of partly cloudy days, 11. Average number of cloudy days, 6.

WIND—The prevailing winds have been from the south. The highest velocity of the wind during any July was 48 miles, on 5th, 1889

SOLAR OBSERVATIONS, MAY, 1894.—ALTA, IOWA.

BY DAVID E. HADDEN.

Date.	CENTRAL TIME.	NUMBER VISIBLE		Faculæ.	Definition.	REMARKS.
		Groups.	Spots.			
2						Fine prominence on W. limb, small one N. E. limb.
3		8		2	Good...	New group and faculæ on E. limb. A group is on W. limb, disappearing by rotation.
7	5:30 P. M.	5	25	1	Good...	A group in prominent faculæ near W. limb.
12	5 to 6 P. M.	3	20	4	Fair....	All the groups are E. of the central meridian.
13	5:00 P. M.	3	*30	3	Fair....	2 medium large groups. All groups E. of meridian. Small prominences near N. and S. limbs and medium large one on S. E. limb.
15	5:30 P. M.	4	*50	2	Fair....	2 fine groups N. latitude. E. of meridian.
16	5:30 P. M.	6	35	.... . .	Poor...	Small group is on edge of E. limb appearing by rotation. Another new group N. W. quadrant.
18	5:20 P. M.	9	75	2	Fair....	2 fine groups are W. of meridian. New group E. limb.
20	5:00 P. M.	6	53	3	.....	The large groups are near W. limb. Prominences on W., E. and S. limbs. All small.
25	5:30 P. M.	6	20	3	Fair....	Large spot with fine umbra and penumbra E.
26	5:30 P. M.	.....	.....	.... ..	Bad....	New group on edge of E. limb by rotation. The large spot E. is oval shaped.
27	5:00 to 6:10 P. M.	8	18	6	Good...	New group in faculæ by rotation. Extensive area of faculæ near W. limb. Brilliant spot of faculæ in high S. latitude E. of meridian. The large spot which was oval yesterday has divided into 2 umbra with penumbra surrounding. Six of the groups are in south solar latitude. Beautiful double tree-like prominence near E. limb. Fine jets near N. W. limb.
28	5:45 P. M.	8	.....	.....	Poor...	Hazy new small group by rotation.
30	5:10-30P.M	7	20	4	Good...	Small spots forming near the penumbra of the large spot W. Fine large round spot of umbra and penumbra is E. of meridian. Large prominence near S. limb.
31	5:10-40P.M	6	18	3	Good...	The umbra of the large spot W. is again partly united. No disturbance in this spot could be noticed with the spectroscope. Large prominence on E. limb.

NOTE.—Visual observations were generally made with telescope three inches aperture. Spectroscope used has two inch diffraction grating containing 14,438 lines to the inch.

*About.

METEOROLOGICAL DATA FOR MAY, 1894.

STATIONS.	TEMPERATURE OF THE AIR (IN DEGREES FAHRENHEIT).								PRECIP. IN INCHES.		Prevailing direction of wind.	No. of cloudless days.	No. of partly cloudy days.	No. of cloudy days.	No. of rainy days. (.01 inch or more).	Hail storms.	No. of thunder storms.
	Monthly mean.	EXTREMES. Mean maximum.	Mean minimum.	Maximum.	Date.	Minimum.	Date.	Monthly range.	Monthly.	Greatest daily.							
Algona	60 3	.....	.....	92	15	35	19	57	1.20	0.63	NW	21	9	1	5	1	
Alta	60.7	74.4	46.9	94	15	33	19	61	1.54	0.70	NW S	21	7	3	7	..	
Albia	61.7	75.9	47.5	90	15,16	31	19	59	1.65	0.62	S	11	17	3	5	..	
Amana	60.1	71.6	48.6	89	16	34	19	55	3.47	1.50	N	17	10	4	8	..	
Ames	60.4	74.9	45.9	90	14,16	29	19	61	0.87	0.31	NW	19	10	2	6	..	
Ames, Heilman, W. H	.....	.....	.....	.....	.....	.....	.....	.....	0.93	0.33	.....	.....	.....	.....	.....	.....	
Atlantic	59.7	75.0	44.4	91	15	?22	19	69	1 18	0.18	N & S	17	11	3	4	..	
Audubon	60.8	74.5	47.1	89	14	29	19	60	1.73	1.28	S	12	15	4	3	..	
Belle Plaine	60.0	72.5	47.4	89	14,15	31	19	58	1.99	0.68	S	13	11	7	7	..	
Bonaparte	61.8	74.3	49.3	88	15,16	34	19,20	54	2.61	1.62	NW	.....	.....	.....	8	..	
Carroll	59.5	73.8	45.2	88	15,16	26	19	62	1.10	0.55	.....	20	9	2	7	..	
Cedar Falls	60.0	74.6	45.4	89	15,16	33	7,16,19	56	1.80	1.00	NW	21	6	4	4	..	
Cedar Rapids	61.8	71.3	52.4	87	15	38	19	49	3.08	0.84	NW N	18	7	6	10	..	
Centerville	64.7	78.0	51.6	86	13	37	30	49	2.71	1.50	NW	25	6	0	2	..	
Charles City	59.7	70.4	48.0	90	15	31	18	59	1.22	0 42	NW	.....	.....	.....	7	..	
Clarinda	62.1	73.5	50.8	88	15,16	38	19,20	50	1.37	1.29	S	22	7	2	4	..	
Clinton	61.5	73.7	49.3	91	16	37	19	54	4.77	2.50	NE	10	15	6	12	..	
College Springs	62.4	75.8	49.0	90	15	33	19	57	1.56	1 38	S	.....	.....	.....	3	..	
Corning	61.4	74.2	49.0	88	15	32	19	56	1.25	1.38	SW	18	12	1	3	..	
Cresco	58.1	69.9	46.3	86	15	33	19	53	2.63	0.93	NW	18	11	2	8	..	
Davenport	61.0	71.0	51.9	87	16	37	20	50	1.93	....	SW	10	12	9	7	..	
Delaware	59.4	.....	.....	87	15	39	19	48	1.91	0.51	S NW	15	13	3	9	..	
Des Moines	62.2	73.2	50.2	90	16	36	19	54	1.41	0.56	SW	21	9	1	9	2	
Dubuque	62.0	70.9	52.1	89	15	40	20	49	1.75	....	NW	10	13	8	9	..	
Elkader	60.4	73.8	47.0	91	15	31	19	60	1.73	0.68	N	19	10	2	5	1	
Emmetsburg	.....	.....	.....	.....	.....	.....	.....	.....	1.22	0.51	NE	26	2	3	6	1	
Forest City	58.4	72.0	44.8	91	15	33	9	52	2.57	1.10	N	24	5	2	5	..	
Ft. Madison	66.4	.....	.....	89	14,15	48	18	41	2 79	1.40	SW	.....	.....	.....	6	1	
Galva	60.7	74.0	36.4	95	15	29	19	66	2.16	0.75	N SW	15	12	4	8	..	
Glenwood	66.4	80.9	51.7	94	2	32	19	62	1 00	0.92	S	16	12	3	2	..	
Grand Meadow	59.5	.....	.....	90	28	43	2	47	2 31	0.73	NW	11	16	4	10	..	
Greenfield	62.0	75.8	48.2	90	16	32	19	58	1 01	0 44	SE	17	11	3	6	1	
Grinnell	62.3	71.6	53.0	86	16	35	19	51	2.71	1.48	S	18	7	5	9	1	
Grundy Center	59.0	72.0	46.0	89	15	29	18	60	1.51	0.90	NW	22	7	2	11	1	1
Hampton	59.2	72.5	46.5	90	15	32	19	58	1.08	0.34	SW	16	15	0	9	..	
Hawkeye	.....	.....	.....	.....	.....	.....	.....	.....	2.26	.....	.....	.....	.....	.....	6	..	
Hopeville	61.8	73.5	50.0	88	16	34	19	54	1.21	0.53	N	7	23	1	4	..	
Hopkinton	58.0	.....	.....	87	15	39	28	48	2.93	1.25	NW	5	21	5	6	2	
Humboldt	.....	.....	.....	.....	.....	.....	.....	.....	1.75	.....	S	11	19	1	8	..	
Independence	59.4	71.7	47.1	87	15	32	19,20	55	1.80	0.75	SE NW	21	7	3	7	..	
Indianola	62.4	75.8	49.1	88	14	32	19	56	1.03	0.44	SW	14	14	3	6	1	
Iowa City	60.6	73.5	47.7	88	15,16	34	19	54	3.09	0.74	NW	2	4	25	11	1	
Iowa Falls	57 6	73.0	44.9	88	15	30	19	58	1.63	0.51	NE	21	4	6	8	..	
Keokuk	63.0	72.0	54.0	88	15	38	19	50	3 06	....	N	14	13	4	7	..	
Keosauqua	62.6	74.2	51.1	89	14	37	20	52	2.01	1.60	.....	.....	.....	.....	4	..	
Larrabee	60.4	75.6	45.3	94	15	28	19	66	1 18	0.36	.....	16	11	4	4	..	
Logan	64.0	79.1	48.9	96	14	27	19	69	0.55	0.45	S	25	1	5	3	..	
Le Claire	.....	.....	.....	.....	.....	.....	.....	.....	2.89	.....	.....	.....	.....	.....	11	..	
Mason City	58.4	71 8	45.0	91	15	34	11	57	1.88	0.62	.....	21	0	10	7	..	
Maxon	63.4	.....	.....	90	15	42	10	48	1 64	0.55	.....	3	27	1	4	..	
Mechanicsville	59.5	71.4	47.6	87	16	33	19	54	3.07	1.40	SW	10	12	9	8	2	
Monticello	60.6	71.7	49.4	90	14,15	34	28	56	1.55	0.73	S	22	6	3	7	1	
Mt. Pleasant	61.9	.....	.....	83	15	46	19	37	3.80	2.30	SW	20	5	6	9	..	
Mt. Vernon	61.4	.....	.....	86	15	42	20	44	4.05	....	.....	.....	.....	.....	9	..	
North McGregor	.....	.....	.....	.....	.....	.....	.....	.....	1.81	.....	.....	.....	.....	.....	.....	.....	
Newton	61.8	75.2	48.5	91	16	32	19	59	1.06	0.35	S	16	12	3	7	1	
Omaha (Neb.)	65.0	75.8	53.2	91	15	38	19	53	0 61	....	N	10	13	8	7	..	
Osage	58.1	.....	.....	.....	.....	.....	.....	.....	2.92	1 05	S	15	9	7	7	..	
Ottumwa	62.0	73.8	50.2	89	16	36	19	53	2.86	1.00	W	19	12	2	9	..	
Ovid	61.4	74.8	47.8	88	16	29	19	59	1.23	0.71	NW	12	12	7	8	1	
Panama	62.4	75.7	49.0	91	15	32	19	59	1.03	0.75	SW	20	7	4	6	..	
Richland	60.9	.....	.....	90	15,16	42	18,19	48	2.15	0.88	.....	9	21	1	7	2	
Rockwell City	.....	.....	.....	.....	.....	.....	.....	.....	0 78	0 49	.....	22	9	0	6	..	
Rock Rapids	60.2	76.4	44.1	95	15	28	19	67	0.33	0.33	S	15	16	0	1	..	
Sac City	60.8	71.7	50.3	91	15	32	19	59	2.10	1.00	Nw NE	14	15	2	5	..	
Seymour	62.2	74 5	49.8	90	15,16	31	19	59	0.95	0.65	S	18	8	5	3	1	
Sibley	58.6	74.0	43.1	93	15	30	19	63	3.59	2.05	NE S	.....	.....	.....	6	..	
Sutherland	59.8	73.6	45.8	95	15	33	20	62	1.16	0.40	.....	.....	.....	.....	7	..	
Sioux City	62.4	75.0	49.8	94	15	33	19	61	1 91	....	S	17	10	4	9	..	
Spirit Lake	59 4	73.4	45.4	95	15	32	19	63	2 55	0.66	NW	20	9	2	8	..	
Toledo	63.5	.....	.....	94	15	30	19	64	0.55	....	S	23	2	6	6	..	
Vinton	60.8	.....	.....	.....	.....	.....	.....	.....	1.94	.....	.....	.....	.....	.....	6	..	
Washington	60.4	.....	.....	90	16	34	19	56	2 54	1.06	SW	.....	.....	.....	3	..	
Webster City	63 0	.....	.....	93	15	41	18,19	52	0 95	0.35	NE	19	11	1	6	1	
West Bend	59.4	.....	.....	90	15	41	19	49	1 52	0.88	N	.....	.....	.....	5	1	
Williams	59.4	.....	.....	92	15	29	19	63	0.86	0.28	S	22	6	3	7	..	
Winterset	62 2	75.5	48.9	94	15	34	20	60	1 44	0.64	NE	18	8	5	5	2	
Means	61.1	73.9	48.1	90.0	.....	34.0	....	56 0	1.87	...	S	17	10	4	6	..	

DAILY AND MONTHLY MEAN TEMPERATURE FOR MAY, 1894.

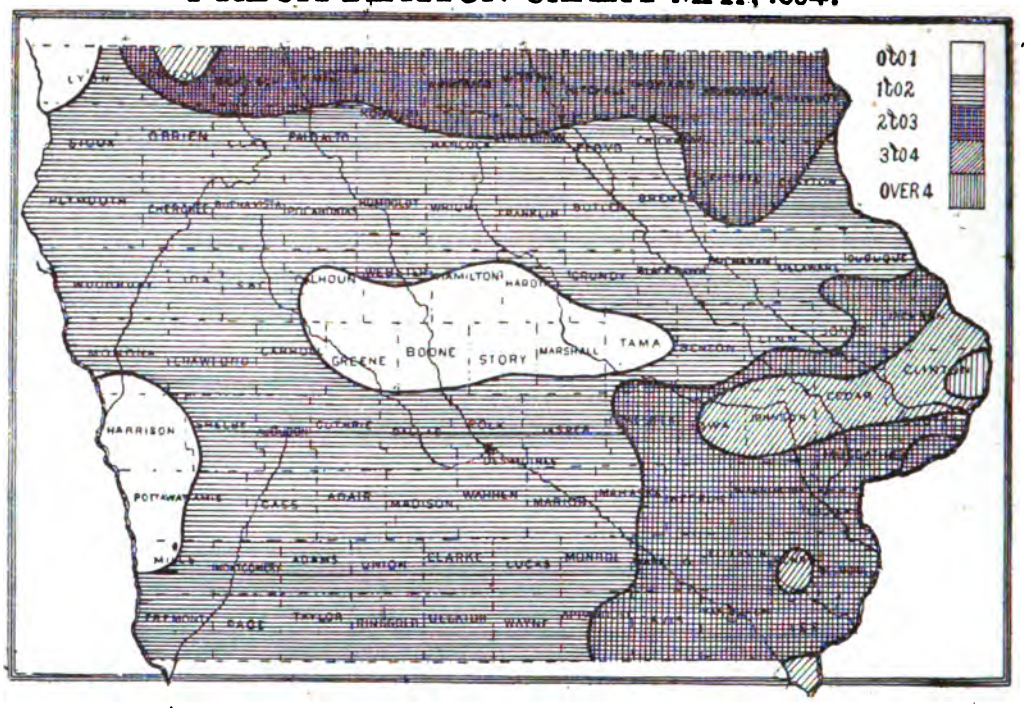
STATIONS.	DATE.																													Monthly Mean.
	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	31st.	
Algona	50	60	53	63	64	63	58	62	66	54	60	70	75	79	80	74	58	47	48	54	55	51	59	62	65	67	56	58	63	52	58	60.3
Alta	53	56	53	60	66	58	59	60	68	52	56	72	72	77	79	77	59	47	48	51	52	55	56	66	65	70	58	57	65	55	59	60.7
Albia	56	58	53	58	68	62	60	60	64	54	54	64	72	74	78	80	72	50	46	50	52	57	58	64	66	68	66	58	64	64	62	61.7
Amana	58	57	58	56	68	62	60	58	62	54	54	64	70	76	76	78	72	49	47	50	50	56	60	62	65	66	58	52	60	52	55	60.1
Ames	56	54	56	62	62	60	60	56	66	56	55	62	70	76	77	79	66	50	47	52	52	52	60	62	64	66	62	54	62	54	58	60.4
Atlantic	56	58	57	56	68	62	49	60	69	51	53	65	72	76	78	78	64	49	43	46	52	52	59	57	58	64	58	54	70	62	54	59.7
Audubon	56	56	58	58	65	61	61	58	69	52	54	65	72	76	78	76	62	50	46	52	52	54	60	63	63	68	62	56	66	60	56	60.8
Belle Plaine	54	56	57	54	68	62	58	61	66	54	54	62	72	76	77	76	72	50	45	49	50	54	59	62	64	66	58	54	62	53	56	60.0
Bonaparte	62	59	63	58	68	64	62	62	62	56	58	64	71	74	76	78	74	52	48	50	52	54	58	58	64	67	60	58	64	63	54	61.8
Carroll	59	54	52	61	67	56	56	52	66	54	62	66	71	70	75	74	72	57	44	52	51	54	60	54	57	62	57	50	59	62	66	59.5
Cedar Falls	60	...	...	...	57	58	49	58	54	58	52	72	73	75	78	66	66	50	49	53	52	54	62	63	64	66	60	56	63	52	62	60.0
Cedar Rapids	62	58	58	56	69	68	62	59	66	58	60	64	72	77	78	79	76	50	49	50	56	55	60	62	66	66	58	59	58	53	56	61.8
Centerville	54	62	66	66	70	64	65	70	70	69	70	71	72	74	71	68	67	64	60	59	60	62	66	66	69	64	62	60	55	54	57	64.7
Charles City	64	60	54	59	62	60	60	55	55	64	52	62	73	75	79	76	68	48	46	49	50	52	76	61	57	66	64	52	60	56	58	59.7
Clarinda	58	62	56	60	68	67	63	61	69	55	56	65	72	76	78	77	64	52	50	52	56	54	57	62	64	67	59	57	68	62	58	62.1
Clinton	64	60	64	58	70	62	59	60	62	56	56	65	67	74	78	80	78	53	50	52	49	54	58	60	64	66	60	58	62	52	58	61.5
College Springs	58	62	59	60	62	62	65	62	69	59	56	66	69	76	78	78	64	51	49	54	56	52	58	62	63	64	62	64	66	64	...	62.5
Corning	57	60	59	60	...	65	...	59	66	59	56	64	72	76	78	78	63	52	48	52	54	53	58	60	62	64	62	55	67	65	56	61.4
Cresco	60	54	54	53	60	56	54	54	64	54	52	65	70	74	76	72	68	45	46	49	49	52	58	60	64	66	52	52	60	56	54	58.1
Davenport	61	60	62	58	70	62	62	62	62	56	58	66	72	78	78	78	47	48	50	50	52	57	62	64	67	60	56	62	52	58	61	61.4
Delaware	58	54	58	56	62	56	56	62	62	53	55	65	70	76	76	76	68	46	48	52	49	52	59	60	71	66	54	56	58	50	57	59.4
Des Moines	56	58	58	60	68	64	62	62	68	57	57	66	74	77	78	80	66	51	50	54	53	54	60	64	66	68	58	56	64	60	58	62 2
Dubuque	64	58	60	57	68	62	59	60	62	58	58	66	71	76	78	80	77	50	50	54	50	53	58	62	62	68	58	58	62	50	58	61.5
Elkader	62	58	58	55	65	60	57	58	62	54	54	66	70	76	80	78	72	49	47	51	45	56	62	64	68	68	57	54	62	52	56	60.4
Forest City	55	56	50	60	62	54	60	63	46	58	54	69	74	73	79	69	58	44	48	48	54	54	59	58	64	66	49	58	60	51	61	58.4
Ft. Madison	62	65	67	65	74	69	64	69	63	58	62	72	76	81	80	80	76	53	54	62	56	59	62	64	68	74	67	64	70	60	65	66.4
Galva	51	58	55	60	66	58	55	59	68	52	55	68	69	77	80	78	62	49	46	51	52	54	56	58	61	70	56	57	65	58	55	60.3
Glenwood	66	70	66	70	71	69	67	64	72	58	58	70	76	80	81	82	61	54	48	55	63	58	62	64	66	73	67	66	72	66	64	66.4
Grand Meadow	54	55	54	58	60	56	55	60	62	52	58	64	70	77	78	80	66	48	48	54	59	52	60	60	66	70	52	56	59	54	60	59.5
Greenfield	58	58	56	60	68	62	60	62	68	58	58	66	74	76	78	79	64	50	48	54	54	52	58	61	64	70	60	60	65	63	57	62.0
Grinnell	60	56	60	60	66	62	59	61	65	59	59	67	73	76	80	78	74	57	47	52	50	52	58	60	64	70	62	62	68	61	56	62.3
Grundy Center	52	58	52	62	64	60	55	58	65	49	58	68	73	76	76	72	69	43	46	52	52	53	58	56	64	66	50	59	63	49	61	59.0
Hampton	58	54	52	56	62	54	56	58	66	52	55	66	73	75	78	76	66	48	47	48	51	52	58	60	63	68	56	55	61	53	55	59.2
Hopeville	56	59	59	66	65	61	60	67	57	57	56	65	72	75	77	78	66	54	48	52	53	52	58	60	64	69	62	58	66	62	57	61.8
Hopkinton	60	58	60	52	60	58	57	61	61	56	53	59	66	70	71	72	67	47	49	51	49	51	58	58	63	62	54	50	58	50	53	58.0
Independence	59	54	58	53	63	64	60	58	63	59	53	62	68	73	76	74	70	54	46	48	52	52	58	60	62	65	54	54	60	52	56	59.4
Indianola	60	60	61	54	68	62	61	60	66	61	57	66	72	75	77	78	73	57	48	52	53	55	59	60	66	68	59	57	64	65	57	62 4
Iowa City	60	56	62	54	57	62	58	57	62	58	53	62	70	74	76	76	74	56	47	50	56	55	60	59	64	63	64	54	60	57	54	60.6
Iowa Falls	54	54	52	55	59	58	57	55	51	...	54	63	70	73	76	73	65	48	44	52	49	52	54	56	60	64	53	52	60	50	54	57.6
Keokuk	64	60	63	61	70	66	64	64	64	60	60	69	72	76	79	78	78	50	49	52	50	54	59	60	63	68	65	59	66	60	56	63.0
Keosauqua	62	60	59	57	69	65	64	62	64	58	58	66	72	76	78	80	74	56	50	52	52	56	59	60	66	68	61	58	66	60	59	62.6
La Crosse (Wis.)	64	56	58	56	62	60	58	58	64	54	56	68	72	76	78	73	70	48	50	55	52	54	60	62	68	68	52	54	59	52	59	60.0
Larrabee	56	56	54	60	66	58	58	59	68	52	56	68	73	78	82	75	56	48	46	49	52	56	56	62	64	72	56	60	56	55	56	60.4
Logan	60	66	62	64	71	64	62	62	65	56	55	68	80	80	80	82	59	52	48	54	57	57	65	65	68	72	47	60	64	70	70	64.0
Mason City	58	47	53	66	58	54	54	67	60	50	52	66	73	75	78	76	66	58	44	48	50	54	58	59	60	54	52	50	56	58	54	58.4
Monticello	64	62	57	54	60	58	57	68	58	58	67	74	72	76	76	78	78	74	46	50	48	54	62	63	64	64	54	51	61	50	54	60.6
Mt. Vernon	58	60	58	62	66	62	58	62	64	55	58	68	74	76	77	76	71	42	50	57	50	56	60	63	65	64	55	60	62	49	60	61.4
Mt. Pleasant	65	56	62	58	70	64	62	62	67	54	58	64	72	76	76	80	75	49	51	51	50	54	58	60	67	66	60	56	64	54	58	61.9
Newton	58	56	59	58	68	62	62	60	67	56	56	68	72	75	78	79	70	54	48	53	51	54	60	64	66	69	61	58	67	57	58	61.8
Omaha (Neb.)	60	67	57	66	70	66	65	65	69	56	59	69	74	78	80	80	62	52	52	56	58	56	61	62	66	74	62	62	66	66	60	62.0
Osage	54	53	51	55	61	56	54	55	64	52	54	64	72	74	76	74	62	46	54	51	50	54	56	60	61	65	52	55	58	52	58	58.1
Ottumwa	60	59	61	57	70	65	64	60	66	55	57	66	72	77	76	78	74	58	48	52	52	54	57	65	64	62	54	56	65	60	56	65.0
Ovid	56	58	58	57	66	64	64	60	64	56	57	64	70	74	78	78	68	52	48	57	53	56	56	66	68	60	56	65	62	57	61	61.4
Panama	58	66	58	66	68	62	62	62	68	54	56	66	73	76	79	78	64	48	48	51	54	59	60	62	62	68	64	60	70	62	58	62.4
Richland	59	60	55	64	62	54	60	61	64	50	58	64	73	76	77	80	71	44	46	54	49	57	56	60	67	70	58	58	66	55	59	60.1
Rock Rapids	56	58	57	62	54	60	58	53	53	61	59	55	71	65	74	74	56	54	44	48	61	62	61	63	70	68	66	54	52	61	54	60.2
Sac City	50	60	61	56	60	64	62	61	62	64	64	67	72	77	78	68	67	60	40	52	50	52	58	60	68	70	57	60	65	57	60	60.8
Seymour	58	54	57	65	67	60	64	62	56	58	56	66	73	75	80	80	57	56	44	50	49	52	56	59	58	74	64	58	65	61	61	62.2
Sibley	58	56	54	60	62	56	49	56	65	50	53	68	72	76	80	76	62	46	46	48	50	52	55	58	60	67	52	54	...	61	56	58.6
Sioux City	58	64	56	64	68	63	62	60	66	53	60	70	75	78	82	78	56	50	50	53	54	55	59	66	62	72	58	58	68	60	58	62.4
Spirit Lake	54	52	52	52	55	54	54	57	66	57	60	70	72	78	81	77	60	50	48	51	53	56	54	56	66	70	58	50	55	63	60	59.4
Sutherland	55	56	54	60	64	58	57	60	65	52	55	69	73	78	81	78	60	45	48	48	52	54	54	59	56	71	53	58	64	54	58	59.8
Toledo	55	64	59	64	71	62	61	61	70	58	60	71	79	84	80	82	73	49	43	54	50	58	54	60	66	75	58	64	66	56	62	63.5
Vinton	57	58	54	59	64	60	58	61	64	55	58	67	73	76	78	78	69	49	50	55	50	54	60	60	63	69	54	58	63	54	59	60.8
Washington	56	57	58	61	64	59	58	62	62	56	59	66	70	76	77	78	68	46	50	54	50	52	57	58	60	60	54	58	65	52	58	60.4
Webster City	53	59	56	62	70	68	66	60	68	55	61	65	73	80	85	76	63	48	50	50	61	63	63	63	61	65	59	60	66	63	62	63.0
West Bend	50	58	...	...	61	56	57	63	62	48	59	66	74	76	78	70	58	45	47	51	54	50	54	60	63	76	56	58	60	51	60	59.4
Williams	52	59	53	63	61	60	57	60	65	48	61	66	70	74	78	71	61	46	45	51	52	53	58	60	64	66	56	61	60	49	62	59.4
Winterset	57	58	57	60	68	62	62	62	68	56	56	66	74	76	79	78	67	51	49	52	53	53	59	62	66	70	60	58	66	62	58	62.2

MAXIMUM AND MINIMUM TEMPERATURE FOR MAY, 1894.

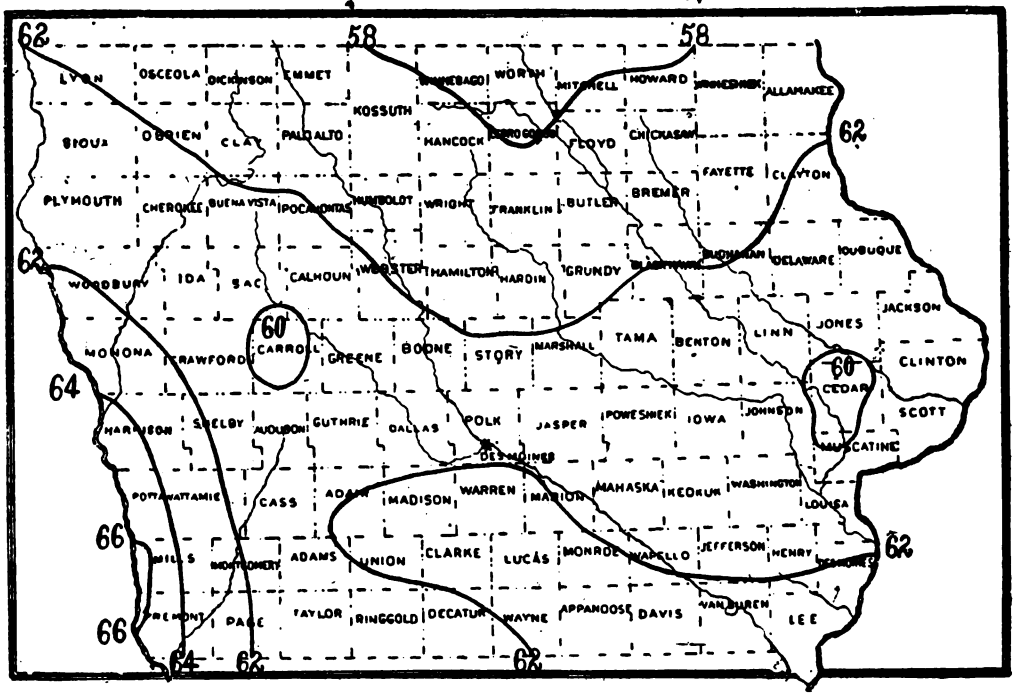
| STATIONS. | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | | 9 | | 10 | | 11 | | 12 | | 13 | | 14 | | 15 | | 16 | | 17 | | 18 | | 19 | | 20 | | 21 | | 22 | | 23 | | 24 | | 25 | | 26 | | 27 | | 28 | | 29 | | 30 | | 31 | | Mon'y Mean. | |
|---|---|---

STATIONS.	DATE.																															Total.
	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	31st.	
Algona	....	....	0.20	0.63	....	....	....	....	0.20	....	....	....	....	....	....	....	0.15	....	....	....	....	T	T	....	....	0.02	....	....	....	....	....	1.20
Alta	0.02	....	0.70	....	....	....	....	....	0.27	....	....	....	....	....	....	....	0 30	....	....	....	....	....	0.03	....	....	0.21	....	....	0.01	....	....	1.54
Albia	0.21	....	....	....	0.38	T	T	....	....	0.62	....	....	....	....	....	....	T	T	....	....	0.02	....	T	T	T	....	....	....	T	....	....	1.65
Amana	0.53	....	....	....	T	1.50	0.12	....	....	0.68	....	....	....	....	....	....	0.13	0.37	....	....	....	0.11	....	....	0.03	....	....	....	....	....	....	3.47
Ames Ex. station	....	0.10	....	....	0.19	0.06	....	....	0.33	....	....	....	....	....	....	....	0.05	....	....	....	....	0.15	....	....	....	0.05	....	....	....	....	....	0.93
Ames	....	0.11	....	....	0.09	0.14	....	....	0.31	....	....	....	....	....	....	....	....	....	....	....	....	0.17	....	....	....	....	....	0.05	....	....	....	0.87
Atlantic	....	0.28	....	....	....	....	....	....	....	0.81	....	....	....	....	....	....	....	0.07	....	....	....	0.02	T	T	....	....	....	....	....	....	....	....	1.18
Audubon	....	1.28	....	....	....	....	....	....	0 43	....	....	....	....	....	....	....	....	....	....	....	....	0.02	....	....	....	....	....	....	....	....	....	....	1.73
Belle Plaine	0.35	....	....	....	0.68	....	0.09	....	....	0.58	....	....	....	....	....	T	....	0.13	....	....	0.05	....	....	0.11	....	....	....	....	....	....	....	....	1.99
Bonaparte	0.16	....	....	....	0.14	0.07	....	....	1.62	0.16	....	....	....	....	....	....	....	0.14	....	....	0.08	....	....	0.24	....	....	....	....	....	....	....	....	2.61
Carroll	....	0.05	0.09	....	0.14	T	T	....	0.55	....	....	....	....	....	....	....	0.25	....	....	....	....	0.01	....	....	....	0.01	....	....	....	....	....	....	1.10
Cedar Falls	0.25	....	....	....	1.00	....	....	....	0.50	....	....	....	....	....	....	....	....	T	....	....	....	0.05	....	....	....	....	....	....	....	....	....	....	1.80
Cedar Rapids	0.43	0.45	....	....	....	0.54	0.02	....	....	0.81	0.03	....	....	....	....	....	....	0.48	....	....	....	0.14	0.07	T	0.11	T	T	....	....	....	....	3.08
Centerville	....	....	....	....	1.21	....	....	....	....	1.50	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	T	....	....	....	....	....	2.71
Charles City	....	....	0.26	....	0.06	....	....	....	0.04	0.33	....	....	....	....	....	....	T	0.42	....	....	0.03	0.08	....	....	....	....	....	....	....	....	....	....	1.22
Clarinda	....	....	0.06	....	....	....	....	....	....	1.29	....	....	....	....	....	....	T	T	....	....	....	0.01	....	0.01	....	....	....	T	....	....	....	....	1.37
Clinton	0.14	....	....	....	2.50	0.42	0.04	....	0.01	0.63	....	....	....	....	0.07	....	....	0.34	....	0.07	0.23	0.15	....	....	0.09	....	....	....	....	....	....	....	4.77
College Springs	....	....	....	....	....	....	....	....	1.38	....	....	....	....	....	....	....	....	T	....	....	....	T	....	0.12	....	....	....	....	0.06	....	....	....	1.56
Corning	0.15	....	T	....	....	T	....	....	....	1.05	....	....	....	....	....	....	T	....	....	....	0.09	....	....	....	....	....	....	....	....	....	....	....	1.29
Cresco	0.14	....	0.31	....	0.63	....	....	....	0.38	....	....	....	....	....	....	0.03	0.93	....	....	....	0.13	....	....	....	....	0.08	....	....	....	....	....	....	2.63
Davenport	0.27	....	....	....	T	0.36	0.03	....	T	0.97	....	....	....	T	....	....	T	0.13	....	....	0.16	T	0.01	T	....	....	....	....	....	....	....	....	1.93
Delaware	0.13	....	....	....	0.21	0.04	....	....	0.18	0.35	....	....	....	....	....	0.11	0.45	....	....	....	0.12	....	....	0.02	....	....	....	T	....	....	....	....	1.91
Des Moines	0.17	....	0.04	....	0.21	0.03	0.06	....	....	0.56	....	....	....	....	....	....	....	0.12	....	....	....	0.21	T	0.01	....	....	....	....	....	T	....	....	1.41
Dubuque	0.50	....	....	....	0.18	0.24	....	....	....	0.48	....	....	....	....	....	....	T	0.10	....	....	0.18	0.04	....	0.01	0.02	....	....	....	....	....	....	....	1.75
Elkader	0.19	....	....	....	0 68	T	....	....	....	0.50	....	....	....	....	....	T	T	0.15	....	....	0.20	....	....	....	....	T	....	....	....	....	....	....	1.73
Emmetsburg	....	....	....	0.51	0.36	....	....	....	0.11	....	....	....	....	....	....	....	0.09	....	....	....	....	0.07	....	....	....	0.07	....	....	....	....	....	....	1.22
Forest City	0.25	....	0.22	....	1.10	....	....	0.69	....	....	....	....	....	....	....	....	0.31	....	....	....	....	....	....	....	....	T	....	....	....	....	....	....	2.57
Ft. Madison	....	....	....	....	....	0.05	T	....	0.52	1.40	....	....	....	....	....	....	....	....	....	....	0.10	0.12	....	0.60	....	....	....	....	....	....	....	....	2.79
Galva	0.75	T	0.36	....	....	0.02	0.04	....	0.25	....	....	....	....	....	....	....	0.22	0.09	....	....	....	....	....	....	....	0.43	....	....	....	....	....	....	2.16
Glenwood	0.08	....	....	....	....	....	....	....	....	0.92	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1.00
Grand Meadow	0.03	....	0.32	0.24	0.50	....	....	....	....	0.73	....	....	....	....	....	T	0.05	0.27	....	....	....	0.17	....	....	....	0 03	....	....	....	....	....	....	2.31
Greenfield	T	....	0.02	....	0.34	0.02	0.01	....	0 44	....	....	....	....	....	....	....	T	....	....	....	....	0.18	....	....	....	....	....	....	....	....	....	....	1.01
Grinnell	....	....	....	....	1.48	0.02	0.08	....	....	0.45	....	....	....	....	....	....	....	0.30	....	....	0 18	....	0.02	0.05	0.13	T	....	....	....	....	....	....	2.71
Grundy Center	0.03	0.03	....	....	0.90	....	....	....	0.28	....	....	....	....	....	....	....	0.07	0.06	....	....	0.04	0.03	0.02	0.03	....	0.02	....	....	....	....	....	....	1.51
Hampton	0.04	0.03	0.34	0.20	T	....	....	....	0.13	....	....	....	....	....	....	T	0.10	....	....	....	0.11	0.07	....	0.46	....	T	....	....	....	....	....	....	1.08
Hawkeye	....	....	0.54	0.40	0.18	....	....	....	T	0.70	....	....	....	....	....	....	....	0.44	....	....	....	0.10	....	....	....	....	....	....	....	....	....	....	2.26
Hopeville	0.49	....	....	....	....	0.04	....	....	....	0.53	....	....	....	....	....	....	....	....	....	....	....	0.15	....	....	....	....	....	....	....	....	....	....	1.21
Hopkinton	1.25	....	....	....	0.55	....	....	....	....	0.48	....	....	....	....	....	....	T	0.40	....	....	0.20	....	T	0.05	....	T	....	....	....	....	....	....	2 93
Humboldt	0.16	0.26	0.19	....	0.28	....	....	....	0.64	....	....	....	....	....	....	....	0.08	....	....	....	....	0.09	....	....	....	....	....	0.05	....	....	....	....	1.75
Independence	0.20	....	....	....	0.70	0.05	....	....	....	0.20	....	....	....	....	....	....	....	0.30	....	....	0.25	T	0 10	....	....	....	....	....	....	....	....	....	1 80
Indianola	0.44	....	....	....	0.08	0.08	0.03	....	....	0.37	....	....	....	....	....	....	....	T	....	....	....	T	....	0.03	....	....	....	T	....	....	....	....	1.03
Iowa City	0.44	....	....	....	0.74	0.31	0.07	....	....	0.78	....	....	....	....	....	....	T	0.32	....	....	0.09	0.18	0.08	0.08	T	....	....	....	....	....	....	....	3.09
Iowa Falls	0.31	....	0.23	....	0.08	0.03	....	....	....	0.51	....	....	....	....	....	....	....	....	....	....	....	0.05	....	0.38	....	0.04	....	....	....	....	....	....	1.63
Keokuk	0.28	....	T	....	....	0.49	T	....	0.52	1.65	....	....	....	....	....	....	....	0.04	....	....	0.02	....	T	T	....	0.06	....	....	....	....	....	....	3.06
Keosauqua	0.20	T	....	....	....	0.18	....	....	....	1.60	....	....	....	....	....	....	T	T	....	....	0.03	T	T	T	....	....	....	....	....	....	....	....	2.01
La Crosse (Wis.)	0.24	T	0.17	....	0.52	T	....	....	....	0.51	....	....	....	....	....	0.07	0.01	1.10	....	....	0.15	0.03	0.05	0.02	T	0.05	0.10	....	....	....	....	....	2.92
Larrabee	0.15	0.36	....	0.23	....	..	....	....	0.11	....	....	....	....	....	....	....	0.16	....	....	....	....	....	....	....	....	0.17	....	....	....	....	....	....	1 18
Logan	....	0.08	....	....	....	....	....	....	0.45	....	....	....	....	....	....	....	....	....	....	0.02	....	....	....	....	....	....	....	....	....	....	....	....	0.55
Le Claire	0.71	....	....	....	0.90	0.02	....	....	....	0.37	0.31	....	....	....	....	....	....	0.27	0.11	....	0.03	0.13	0.02	0.02	....	....	....	....	....	....	....	....	2.89
Mason City	....	0.35	0.64	....	....	....	....	....	0.34	....	....	....	....	....	....	....	....	0.42	....	....	....	0.12	....	....	....	0.09	....	....	....	....	....	....	1.98
Maxon	0.28	....	....	....	0.40	....	T	....	T	0.55	....	....	....	....	....	....	....	0.41	....	....	....	T	....	T	T	....	....	....	....	....	....	....	1.64
Mechanicsville	0.40	....	....	....	1.40	0.10	....	....	....	0.63	....	....	....	....	....	T	T	0.01	....	....	0.10	0.13	....	....	0.30	....	....	....	....	....	....	....	3.07
Monticello	0.73	....	....	....	0.07	....	....	0.44	....	....	....	....	....	....	....	....	T	0.08	....	....	0.18	0.02	....	T	0.03	....	....	....	....	....	....	....	1 55
McGregor	0.36	....	0.02	....	0.20	T	....	....	....	0.29	....	....	....	....	....	0.02	....	0.65	T	....	0.18	0.01	....	0.08	....	T	....	....	....	....	....	....	1.81
Mt. Pleasant	....	....	....	....	0.33	0.31	....	....	0.20	2.30	....	....	....	....	....	....	....	0.08	....	....	T	0.37	0.04	0.13	0.04	....	....	....	....	....	....	....	3.80
Newton	0.29	....	....	....	0.20	0.03	0.04	....	....	0.35	....	....	....	....	....	T	....	0.10	....	....	0.05	....	T	T	T	....	....	....	....	....	....	....	1.06
Omaha (Neb.)	0.02	....	0.08	....	....	T	0.01	....	0.22	0.11	....	....	....	....	....	T	T	T	....	....	....	T	T	T	....	....	T	T	0.01	0.16	....	0.61
Osage	0.21	....	0.23	....	0.75	....	....	....	1.05	....	....	....	....	....	....	....	0.53	....	....	....	....	0.06	....	....	....	0.09	....	....	....	....	....	....	2.52
Oskaloosa	0.50	....	....	....	0.25	....	T	....	....	0.25	....	....	....	....	T	....	....	....	....	....	T	....	....	....	0.80	....	....	....	....	....	....	....	1.80
Ottumwa	0.08	....	....	....	0.10	0.14	T	....	....	1.00	....	....	....	....	....	....	0.30	0.15	....	....	0.03	....	T	0.33	0.03	....	....	....	....	....	....	....	2.86
Ovid	0.30	....	....	....	0.01	0.10	....	....	....	0.71	....	....	....	....	0.02	....	....	0.09	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1.23
Panama	....	0.02	....	....	....	0.10	....	....	0.75	....	....	....	....	....	....	....	0.03	0.07	....	....	....	....	....	0.06	....	....	....	....	....	....	....	....	1.03
Richland	0.37	....	....	....	0.37	....	0.04	....	....	0.88	....	....	....	....	....	T	T	0.17	....	....	0.07	....	....	0.25	....	....	....	....	....	....	....	....	2.15
Rockwell City	....	....	....	0.05	0.02	0.02	....	....	0.49	....	....	....	....	....	....	....	0.15	....	....	....	....	0.05	....	....	....	....	....	....	....	....	....	....	0.78
Rock Rapids	....	....	....	0.33	....	....	....	T	....	....	....	....	....	....	....	....	....	....	....	....	....	T	T	....	....	....	....	....	....	....	....	0.33
Sac City	0.10	....	0.50	....	....	....	....	....	....	....	....	....	....	....	....	....	1.00	....	....	....	....	0.25	....	....	....	0.25	....	....	....	....	....	....	2.10
Seymour	0.20	....	....	....	....	T	0.10	....	....	T	0.65	....	....	....	....	....	....	T	....	....	....	....	T	....	....	....	....	....	....	....	....	....	0.95
Sibley	2.05	T	....	0.42	0.25	....	....	....	0.48	....	....	....	....	....	....	....	0.31	....	....	....	....	T	....	....	....	....	....	0.08	....	....	....	....	3 59
Sutherland	0.40	....	0.34	....	....	....	....	....	0.12	....	....	....	....	....	....	....	0.23	....	....	....	0.01	0.01	....	....	....	0.05	....	....	....	....	....	....	1.16
Sioux City	0.91	....	0.23	....	....	0.04	0.04	....	0.58	....	....	....	....	....	....	....	0.07	0.01	....	....	....	0.01	T	0.02	....	T	....	....	....	....	....	....	1.91
Spirit Lake	0.66	....	0.20	0.64	....	....	....	....	0.39	....	....	....	....	....	....	....	0.49	0.04	....	....	....	0.02	....	....	....	0.11	....	....	....	....	....	....	2.55
Toledo	....	0.05	....	....	....	0.08	0.01	....	....	0 23	....	....	....	....	....	....	....	0.09	....	....	0.09	....	....	....	....	....	....	....	....	....	....	....	0.55
Vinton	0.21	....	....	....	0.06	....	....	....	....	0 52	....	....	....	....	....	....	....	0.22	....	....	0.21	0.72	....	....	....	....	....	....	....	....	....	....	1.94
Washington	1.06	....	....	....	....	0.30	0.05	....	....	0.70	....	....	....	....	....	....	....	0.12	....	....	0.03	....	....	0.28	....	....	....	....	....	....	....	....	2.54
Webster City	0.35	....	....	0.12	0.12	....	....	....	0.12	....	....	....	....	....	....	T	0.12	....	....	....	....	0.12	....	....	....	T	....	....	....	....	....	....	0.95
West Bend	....	0.27	....	0.20	....	....	....	....	0.88	....	....	....	....	....	....	....	0.07	....	....	....	....	....	....	....	....	0.10	....	....	....	....	....	....	1.52
Williams	....	0.08	....	....	0.05	....	....	....	....	0.28	....	....	....	....	....	0.02	0.14	....	....	....	....	0.24	....	....	....	0.05	....	....	....	....	....	....	0.86
Wintersat	0.37	....	....	....	0.19	....	T	....	....	0.64	....	....	....	....	....	....	....	T	....	....	....	0.19	....	0.05	....	....	....	....	....	....	....	....	1.44

PRECIPITATION CHART MAY, 1894.



MEAN TEMPERATURE MAY, 1894.



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Wheatland	D. Beckman.
Willow Creek	W. S. Nicholson.
Winterset	H A. Kinsman.
Wall Lake	F. E. Wilcox.
Walnut	F. L. Martin.
What Cheer	O. D. Lawrence.

Met. 217

UNITED STATES DEPARTMENT OF AGRICULTURE
WEATHER BUREAU.

MONTHLY REVIEW

OF THE

Iowa Weather and Crop Service.

VOL. V.—JUNE, 1894.—No. 6.

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CENTRAL STATION, DES MOINES, IOWA.

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LOCAL FORECAST OFFICIAL,
U. S. WEATHER BUREAU, ASS'T DIRECTOR.

DES MOINES:
G. H. RAGSDALE, STATE PRINTER.
1894.

THE IOWA WEATHER AND CROP SERVICE

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U. S. Department of Agriculture---Weather Bureau.

MONTHLY REVIEW

OF THE

IOWA WEATHER AND CROP SERVICE.

VOL. V.] JUNE, 1894. [No. 6.

JULY CROP REPORT.

Reports from the crop correspondents of this bureau showing the average condition of the staple crops on July 1st, have been received and tabulated, giving the following averages for the State:

Spring wheat, 77 per cent; corn, 107; oats, 66; rye, 80; barley, 70; hay (tame), 43; pastures, 47; millet, 83; broom corn, 90; sorghum, 90; Irish potatoes, 84; sweet potatoes, 81; apples, 71; plums, 74; grapes, 68; blackberries, 77. A special inquiry relative to the acreage and condition of flax showed a decrease of 15 per cent in the area planted, and rated its condition 75 per cent. This year's acreage will be 211,460 acres.

Owing to the continuance of the drouth the condition of all immature crops has fallen off somewhat since the 1st of July, on which date the reports were mailed.

EDITORIAL NOTES.

The old saying that lightning never strikes twice in a place was exploded recently by a second stroke on the tower of the Plymouth Congregational Church, of Des Moines, the first stroke occurring two or three weeks earlier. The first was a direct and audible call to duty; the second was a penalty for sin—the sin of omission in the matter of providing a good lightning rod for the tower. The next call may be a settler.

***

Alexander McAdie, of the U. S. Weather Bureau, in his recent pamphlet on "Protection from Lightning," says: "Lightning does sometimes strike twice in a place. Whoever studies the effects of lightning's action, especially severe cases, is almost tempted to remark that there is often but little left for the lightning to strike again. No good reason is known why a place that has been struck once may not be struck again. There are many cases on record supporting the assertion."

***

The editor of the May *Bulletin* of the New England Weather Service expresses the cheerful belief that the day is not distant when a large part of the household duties and farm machinery work will be done by electric power obtained from the streams that for ages have been running to waste. When the storage battery is perfected the most important factor for work will be the wind, especially in sections too remote from the streams to be served by water power.

***

Severe windstorms, assuming the form of tornadoes in various localities, swept over portions of South Dakota and Minnesota on the night of June 27th, resulting in the death of thirteen persons and the destruction of much property.

***

Rainmaker Jewell has made a failure in South Dakota which is not all a failure. He began operations Tuesday, June 19th, and was to have $600 if he produced half an inch of rain throughout the county by Sunday, 3 P. M. He worked faithfully, but no rain fell at Sioux Falls. Rain did fall, however, all around him, and he claims that high winds blew his elixir into the adjoining counties and caused rain there. He does not demand the money, neither does he admit the failure. Verily, the way of the rainmaker is hard. In the meantime Providence does business at the same old stand.—*Saturday Review.*

***

A severe wind squall, with some tornado characteristics, passed near Marysville, Marion county, on the night of June 29th. It was about twenty rods in width, but it cleaned everything in its pathway for a short distance. The only building struck was Chas. Sims' barn, which was totally wrecked.

***

The area of the woodland of the British isles is now reduced to about 3,000,000 acres, which is 39 acres to each 1,000 of the country's total area. This is a smaller proportion than that in almost every other European country. Austria-Hungary has 343 acres of forest to each 1,000 acres; Russia, 342; Germany, 257; Sweden and Norway, 250; France, 159; Italy, 145; Belgium, 142; Holland, 72; Denmark, 60. It is estimated that in addition to about $15,000,000 in tropical woods, Great Britain imports annu-

ally $60,000,000 worth of oak, ash, pine, etc. It is believed that the latter expense could be saved to the country by the afforestation of 6,000,000 acres of what is now waste land—a work that Dr. Schlich calculates would require 15.000 laborers, if the planting was done at the rate of 300,000 acres yearly, while it would eventually provide steady employment for 100,000 persons. This problem is now exciting scientific and official interest, and as the future prosperity of Great Britain depends so largely upon a careful husbanding of its resources, so important a source of wealth is not likely to be much longer neglected. —*Exchange.*

***

A remarkable geological substance found in Finland is a stone which foretells, by a change in color, the probable character of the weather in the near future—a natural barometer—known by the name of semakuir, and which is said to turn black shortly before an approaching rain, while in fine weather it is mottled with spots of white. For a long time, it appears, this interesting phenomenon was inexplicable, but on an analysis of the stone it was shown to be a fossil mixed with clay, and containing a portion of rock salt and nitre. This fact being known the explanation of the changes became easy; the salt, absorbing the moisture, turns black when the conditions are favorable for rain, while the dryness of the atmosphere must as naturally bring out the salt from the interior of the stone in white spots on the surface.—*Boston Budget.*

***

Electricity as a motor on street car lines will soon supplant horses in all parts of the world.

***

When the weather is wet
We must not fret;
When the weather is dry
We must not cry;
When the weather is cold
We must not scold;
When the weather is warm
We must not storm;
But
Be thankful together
Whatever the weather.

—*Ancient rhyme.*

***

The people of Western Iowa have about concluded that the rainmakers are hoodoos. They hired the rainmakers and Eastern Iowa got the rain.—*Ex.*

***

The rainmaker is abroad once more. Out in Nebraska he has succeeded in convincing some people that he brought the refreshing showers that fell there and in Kansas on Monday night. But if he claims the credit for that he will have to shoulder the responsibility for the great floods in the northwest, because all those meteorological phenomena had their origin in the same general atmospheric disturbance. A cyclonic center had been hovering over British Columbia and the Puget Sound country for several days, recalling, in some respects, our recent experience on the Atlantic coast, and it was an offshoot of this widespread storm, and not the cloud-compelling devices of the western professors of practical meteorology, that brought the rain to Nebraska.—*New York Sun.*

***

Complaint has been made that the weather in June was too highly seasoned to be fairly seasonable.

***

A Pueblo reporter recently described a local storm in the following manner: "The storm roared through the mountains with the noise of a billion cannon. * * * One barn was unroofed." That fellow deserves promotion.

***

The State Fair — August 31 to September 7 — will undoubtedly be one of the finest exhibits ever witnessed in Iowa, with many new features and attractions. The Weather and Crop Service will establish headquarters on the ground, probably in the cottage erected by the Iowa Columbian Commission, where we shall be pleased to greet all the weather observers and crop reporters of the State. Further particulars will be sent by circulars.

"A MONSTROUS JOKE."

A SCIENTIFIC EXPOSURE OF THE RIDICULOUS RAINMAKING FAKE.

SIOUX FALLS PRESS: The visit of the rainmakers to Sioux Falls at this time, and the attempts which elsewhere in this state and other states have been made to milk moisture from the sky, will give especial interest to the following article upon the question of producing rain at will. It is written by Harley P. Pettigrew, of this city, who is a thoroughly educated scientific gentleman—a graduate in chemistry and kindred sciences. He handles the matter in a style which brings it entirely within the comprehension of the popular mind, and his article will undoubtedly tend to increase the general feeling in this section that the artificial rainmakers in this country or elsewhere have undertaken a task rather too large to warrant any semblance of success except in instances where nature would have provided moisture even if the heavens had not been bombarded. Mr. Pettigrew says:

From the very beginning of the operation of rainmaking in this city, I have been skeptical as to the results, and have regarded the whole thing as a monstrous joke. This view seems to be confirmed by the startling array of figures which have been arrived at by a series of mathematical calculations, and which I believe to be approximately correct.

As rainmaking is now the chief topic of conversation, and as the attempt to produce rain "at will" by artificial means seems to be a failure, in this locality at least, and that too, with the air full of moisture and the barometer column below average, it may be of interest to most readers to learn somewhat of the enormity of the task undertaken by him who would, by mechanical means, compel the atmosphere to yield up its moisture.

It seems to me so utterly preposterous to even think that any number of retorts and gas generators could undo the work of the sun, by counteracting the effect of the heat from the sun upon the earth, and so lower the temperature of the air as to cause precipitation of its

moisture that I could not refrain from making these few calculations for my own satisfaction.

In the first place it was said that rain would be produced over an area twenty-five miles square; this would be equal to sixteen townships of thirty-six square miles each. The whole sixteen townships would thus give an area of 576 square miles.

Now a space one mile square and one mile high, or in other words, a cubic mile, would contain 117,197,952,000 cubic feet of air.

The amount of moisture that can exist as vapor in the air depends on the temperature. There is a certain pressure of vapor corresponding to every temperature which can not be exceeded; beyond this there is condensation. This temperature is called the temperature of saturation for the pressure. When the temperature of the air diminishes until the saturation temperature for the vapor contained is reached, any further fall causes condensation of moisture. The temperature at which this occurs at any time is called the dew-point temperature at that time. The less the quantity of moisture the air contains the lower will be the temperature of its dew-point. Conversely the more vapor present in the air at any time the less will be the reduction in temperature necessary in order to cause condensation. The law of aqueous precipitation may then be stated thus: Whatever lowers the temperature of the air at any place below the dew-point is a cause of rain. And this is, I believe, the theory upon which the gas rainmaking process is based.

Hence, it would be necessary to lower the temperature below the point of this vast body of atmosphere over an area of 576 square miles in order to extract the total moisture contained therein.

Now the amount of moisture contained in the air is very variable at different times.

On very cold days it is exceedingly slight, while on very warm days it is great. At the temperature of zero the air contains a trifle over ½ grain of moisture per cubic foot, while at a temperature of 80 degrees Farenheit this amount would be increased up to a little over 10 grains, or about 12 drops. It is upon a temperature of 80 degrees, with ten grains of water to each cubic foot of air from the surface of the earth up to the sky for a distance of one mile that the following calculations were based.

A cubic mile of air would thus contain 20,123,274 gallons liquid measure, of water. Now multiply the figures as above given by 576—the number of cubic miles to be operated upon—and the result will be dazzling. If all this water could be brought down at once it would give us one and one-fifth inches of rain over the whole area.

In order to cause a precipitation of the entire amount of moisture from a cubic mile of air containing twelve drops of water to each cubic foot it would be necessary to reduce suddenly the temperature of this mass of air from 80 degrees to the zero point, while a partial reduction would result only in partial precipitation. Thus if one-half of this amount of air was operated upon, but half the quantity of vapor would be condensed.

It is not reasonable to suppose that by operating upon a comparatively small portion of this vast body of air, and causing it to yield up its moisture, that the rest will follow suit and rain of its own accord. On the contrary the whole body of air must be treated in order to extract the total moisture contained therein. In the manufacture of ice it is necessary to operate upon every particle of water to be frozen. The icemaker would scarcely expect to freeze one cubic foot of water out of a large tank, and expect the balance to freeze itself. As the freezing is simply carrying the condensation process one step farther than in the production of rainfall, why is the comparison not a good one?

The question then is: Is it possible to so counteract the heat of the sun by the liberation of gases of any kind, or by any mechanical means whatever, as to cause rainfall over an extended area of country?

It seems to me absurdly impossible to expect to produce gas enough of any kind to bring about such results Of course, in a laboratory, on a small scale, under carefully arranged conditions, aqueous vapor within a small glass globe may be caused to fall as snow; but this would scarcely warrant us in saying: "If this is possible, why can't we produce rain outdoors?" For that would be leaving out of consideration the difference in the scale of operation.

I have seen quicksilver contained in an iron spoon frozen into a solid mass by application of chemical means; but think of freezing a ton of quicksilver in the midst of a mighty conflagration!

It is said also that 4,500 cubic feet of gas issue every hour from three small tubes and generators. Now the production of gas in such quantity is no small or trifling operation.

Let us see, then, what amount of material and apparatus would be necessary to the production of that much gas each hour for twenty-four hours. These figures are also startling.

We will take as a basis hydrogen gas, as that is the simplest and easiest gas of all to make, and is used as a standard of measurement, chemically, of all other gases.

To produce hydrogen it is only necessary to bring together in a suitable glass or earthen jar metallic zinc, sulphuric acid and water, each in the proper amount. This in itself is quite simple, as any high school student in chemistry knows. But to make twenty-four times 4,500 cubic feet of this gas is a big task, involving the use of no less than 17,769 pounds of zinc, 26,121 pounds of sulphuric acid, and 10,098 gallons of water, and the tank which would hold this amount would have to be nearly 10 feet square and 30 feet deep, while a five day operation would require a train of cars to haul the material. Of course, I do not mean to convey the idea that hydrogen is the gas which is used, but merely used that as a basis for the calculation.

Most other gases, such as oxygen, chlorine, nitrogen, the oxides of nitrogen, carbonic oxide, etc., are much harder to make than hydrogen, and would require still more material and labor. Now, if rain is to be produced "at will," and the method in any way is a success, it ought to succeed under test conditions, which would be as follows: A bright, sunny day, cloudless sky, no wind,

a uniform temperature of 80° and the air saturated with moisture at that temperature.

If, under such conditions, rain may be produced "at will" without spending five or six days in the "willing," then it might be pronounced a success, and not before.

As test conditions like this can probably never be secured, what living man can decide whether the rain is produced by artificial or natural means?

I am not seeking to disparage the efforts of the rain-maker, for if it is possible to milk the sky at any time we choose, and for a reasonable outlay, by all means let us have a machine. All such doings as this will naturally be talked about. And the projectors thereof must not expect to escape unchallenged. It would be interesting to hear more about the details upon which Aquarius bases his work. But, for my part, it remains simply a big joke

A BRILLIANT SUNRISE SCENE.

CLINTON HERALD, JUNE 30: A startling phenomenon was witnessed in Lyons and vicinity this morning from 4 to 4:30 o'clock, greatly frightening many superstitious people. It began with an illumination of the northwest heavens in blended red and yellow, like the reflection from a tremendous fire, and sufficiently brilliant to awaken many people from sound sleep. It increased in brilliancy until objects looked as they do when viewed through a pair of hunter's colored spectacles. In the southwest, near the horizon, lay a large bank of clouds of inky darkness. Soon the illumination shifted to the northeast, and as the sun arose bright shafts of yellow were shot upward in various directions, contrasting sharply on the background of red. The weirdness of the scene was intensified by a long streak of cloud of a pale green tint along the eastern horizon. But the most awe-inspiring part of the heavenly display came about 4:20 o'clock, when a slender ribbon of a delicate yellow stretched athwart the sky from northeast to southwest, the extreme end reaching far into the black clouds. It resembled the ray from a powerful search light, set with a lens of yellow glass, except it hung in the sky like a rainbow. It lasted about ten minutes, when it vanished, together with all the bright colorings, and the sky was quickly overspread with gray, wintry-looking clouds.

It was a sight never to be forgotten by those who witnessed it, and not a few were stricken with terror at the ghastly appearance of things. Some were inclined to think a cyclone was approaching, and the clouds in the southeast certainly did look foreboding; while other more simple-minded people thought it a harbinger of blood in the great railroad strike.

A DRY YEAR.

The records at the Central Station of the Iowa Weather Service show that the total precipitation (rain and melted snow) at this point, for the year ending June 30th, was 18.55 inches—a little more than one-half the normal amount. A number of other points will doubtless show as great a deficiency, but Des Moines is, at the present time, near the center of the dryest section of the State.

Does that indicate that the State is going dry? Well, let's see. The records show that for the corresponding twelve months, in 1892-93, the total at Des Moines was 33.59 inches; and for the calendar year 1892 the amount was 38.42 inches. This shows only variability—a streak of fat and a streak of lean—but it does not portend a change of climate.

For the three months ending June 30, 1894, the total rainfall at Des Moines was only 4.78 inches. In the corresponding three months in 1893 the amount was 13.04 inches; and for the corresponding period in 1892 the total was 15.54 inches. In those days there were no complaints of drouth.

In respect to the mean relative humidity of the air the records show a marked difference in the present as compared with the two preceding seasons. In April, 1894, the mean humidity was 63.7 per cent; in May, 54.6 per cent; in June, 54.6 per cent. In April, 1892, the humidity was 67 per cent; in May, 78 per cent, and in June 74 per cent. In April, 1893, it was 70 per cent; in May, 69 per cent; in June, 72 per cent.

The range of daily humidity for the past two months has been exceedingly low, and that fact may afford at least a clue to discovery of the cause of the unprecedented drouth of this season. The rains have not fallen because the air itself was arid. You can not squeeze water from a dry sponge. A drouth is simply dry air; and the air is dry because the water has been previously wrung from it and deposited elsewhere. When the humidity is out, you can't cure the trouble by administering physic in form of chemical gases.

VALUE OF STATE WEATHER SERVICES.

Major H. H. C. Dunwoody, Assistant Chief of the U. S. Weather Bureau, recently contributed a paper on the above subject, from which we make the following extract:

"State weather services are organizations for the collection and dissemination of climatological and other information. They depend almost wholly upon the voluntary co-operation of intelligent and public-spirited citizens, whose individual reports collected at the various central stations form the basis of their publications. These publications are reviews of the prevailing weather conditions published monthly, and bulletins issued weekly during the season of planting, cultivating and harvesting of crops, giving the more important weather features, and their effect upon growing crops from week to week. Through state weather service organizations, the daily weather forecasts and special warnings of the national bureau are distributed to large numbers of stations throughout the country.

In the United States there are less than 175 meteorological stations conducted by the regular paid observers of the weather bureau; or about one station for each 22,000 square miles of territory. The utter inadequacy of the data supplied by these stations for purposes of detailed investigation of special localities is therefore plainly apparent, making the state weather service an absolute necessity for the prosecution of such work.

This weather crop service is—with the exception of the general weather forecasts—the most valuable work being done by the national bureau, and is the most popular feature of the state weather service work, being of great interest to agriculturists, although the bulletins are eagerly looked for by those engaged in other pursuits. To the intelligent farmer it affords a means of supplying accurate and important information as to the condition of crops, enabling him to form reliable estimates as to supply and demand. In some states the editions of the local weather crop bulletin have already grown to large proportions, and the demand for the bulletin is constantly increasing. More than 11,000 copies of the Ohio weather crop bulletin are printed and distributed weekly. As an illustration of the importance of this work it may be stated that a material change in the condition of the cotton crop of Texas influences the cotton markets of the world; and it is the work of the state weather service that presents weekly impartial and reliable information as to the actual weather and crop conditions prevailing throughout each season."

WHEAT CROPS DECREASING.

HAY TRADE JOURNAL: Urban population has increased so rapidly in the west and northwest that the wheat-bearing area has largely decreased during the past decade. Twenty-seven per cent of the wheat fields of Ohio, Michigan, Indiana, Illinois and Wisconsin have been diverted during the past thirteen years to the production of such crops as are essential to the subsistence of the millions added to the towns and villages of the lake basin.

In the southern states the large amount of land taken from the wheat area and devoted to cotton growing has sensibly affected our wheat crops. The ten states south of the Potomac and Ohio and east of the Mississippi, included 27 per cent of the wheat area in 1859, and contributed 21 per cent of the grain. This region now embraces less than 12 per cent of the nation's wheat area, and produces only 8 per cent of the grain.

North of Arkansas and the Indian Territory, in the states of the Missouri valley, is now found the granary of the nation. The wheat fields of this group amount to 42 per cent of the nation's area, and with the Pacific states, furnish the surplus that enters into foreign commerce and places us in the first place as an exporter of breadstuffs. But this large wheat area has been steadily declining since 1884, especially in Iowa, where the production of both wheat and corn has been giving place to meadows, oat fields, and dairy farms.

California wheat farms are slowly being converted into orchards and vineyards, but the increase in Washington will probably make good such losses for a decade.

During the ten years ending with 1889, the wheat bearing area of the north Atlantic states, Maine to Maryland, declined 18 per cent, every acre of the diverted wheat fields being employed in growing crops that are more profitable, and are required for local use.

In the lake group, Ohio, Michigan, Indiana, Illinois, and Wisconsin, which held the first place in wheat growing from 1855 to 1882, the decline has been even greater, equaling 23 per cent. All of these acres have been converted into meadows, oat fields, and new pastures demanded by the phenomenal growth of the town population, whose requirements for beef, mutton, and dairy products could be met in no other way.

That it should be necessary to devote all of the new acreage of these states to forage crops and then divert to such products part of the corn area and 23 per cent of the wheat fields, within ten years, shows how rapidly we are trenching upon the acreage devoted to the growth of grain.

NEW FILLING FOR THERMOMETERS.

Quicksilver, with which thermometers are ordinarily filled, is not as useful as it might be, from the fact that just when it is wanted to register an extraordinary degree of frost it has a knack of becoming solid. Alcohol, which is used for the same purpose, frequently contains water, so that its registration can never be altogether depended on. A new filling has been discovered. It is called by chemists "tuluol," and is highly spoken of. It is extracted from coal tar. It contains absolutely no water, can stand a much lower temperature than quicksilver without freezing, and when exposed to warmth expands with great regularity. Besides possessing these admirable properties, it is very cheap; and as it is much lighter than quicksilver the tube of the thermometer can be made much larger than is now usual, and thus it will not only be much easier to read the record, but greater exactitude in registrations will be secured. The dark blue color of tuluol is another element which will contribute to the ease of reading the thermometer.—*Ex.*

HOT WEATHER PHILOSOPHY.

Don't fret about the mercury,
Or watch it all the time,
The old thermometer won't burst,
However it may climb.
It doesn't do you any good
To count up the degrees,
And all your talk about the heat,
Won't start a bit of breeze.

Don't fan yourself too much. It makes
You hotter when you stop.
Don't tell the suffering neighbors that
You feel as if you'd drop.
Don't drink too much cold lemonade;
A glass or two will do.
And don't ask everybody—
"Is it hot enough for you?"

Just go about your daily tasks
As calmly as you can.
Don't hurry; take things easy, and
You will be much happier than
The chap who groans, and frets, and stews,
And fusses all the time.
Just follow this advice and you'll
Be glad you read this rhyme.

—*Somerville Journal.*

The fact should be noted that Iowa crops have suffered more heavily from effects of excessive rains than from drouths. And there has never been a crop failure from either cause.

JUNE WEATHER REPORT.

The month of June was warm and excessively dry. The daily mean temperature for the State was 4 degrees above the normal.

The average precipitation for the State was 2.67 inches —2.28 inches below the June normal. Following the dryest May on record in Iowa, the conditions in June were exceeding unfavorable for all crops except corn. The rainfall was scattering and unequally distributed, ranging from .57 of an inch in Washington to 6.20 inches in Sac City.

But though an unusually dry month the fact is to be noted that there were only two days on which no rain fell at one or more stations in the State, and there were thunder storms reported at some point 22 days in the month.

The following table gives, as a basis for comparison, the mean temperature and total precipitation, at the stations named, for the years from 1872 to 1894, inclusive:

YEARS.	MEAN TEMPERATURE, DEGREES.					PRECIPITATION, INCHES.				
	Des Moines.	Davenport.	Keokuk.	Omaha.	Sioux City.	Des Moines.	Davenport.	Keokuk.	Omaha.	Sioux City.
1872	....	72	75	73	....	.....	3.78	5.81	3.91	.....
1873	....	78	78	74	....	.....	2.16	1.21	5.86	.....
1874	....	73	76	73	....	.....	5.37	4.01	6.93	.....
1875	....	68	71	71	....	.....	4.91	8.33	10.95	.....
1876	....	69	70	68	....	.....	4.25	6.73	3.47	.....
1877	....	69	72	69	....	.....	5.80	7.82	8.36	.....
1878	....	68	70	67	....	.....	4.36	3.93	8.48	.....
1879	70	70	71	73	....	6.69	4.57	2.63	4.09	.....
1880	72	72	74	73	....	4.11	7.20	3.06	3.14	.....
1881	71	70	72	75	....	15.79	7.94	8.70	5.56	.....
1882	68	69	71	71	....	12.16	8.43	9.45	12.05	.....
1883	68	68	69	69	....	7.75	4.38	5.88	12.70	.....
1884	70	70	71	72	....	3.84	3.07	4.03	6.11	.....
1885	69	68	70	71	....	5.03	2.08	6.97	2.67	.....
1886	71	70	71	70	....	1.21	0.49	2.86	1.50	.....
1887	72	73	73	72	....	2.25	1.66	1.55	4.56	.....
1888	69	70	71	70	....	2.32	3.86	5.42	3.86	.....
1889	67	67	68	69	....	4.39	5.59	2.97	5.44	.....
1890	73	74	76	74	72	4.91	4.51	3.41	5.04	3.61
1891	69	71	72	69	68	5.60	3.56	3.66	6.66	7.62
1892	69	70	73	71	69	3.41	10.79	2.65	1.51	1.50
1893	72	72	73	73	72	4.69	3.82	2.37	7.11	1.63
1894	74	75	76	74	72	1.67	2.16	2.85	4.74	2.74
Means	70	70	71	71	71	5.36	4.40	4.99	5.72	3.42

SUMMARY OF WEATHER CONDITIONS.

BAROMETER.—Mean pressure for the month, 29.94 inches. Highest observed 30.28 inches at Omaha (Neb.) on the 6th. Lowest observed 29.50 inches at Sioux City on the 27th; range for the month, 0.78 inches.

Temperature—Monthly mean as deduced from 72 voluntary observers reports, 73.2°. Highest monthly mean 78.5° at Ft. Madison. Lowest monthly mean 69.4° at Cresco, Charles City and Mason City.

The highest temperature reported was 104° at Glenwood on the 29th. The lowest temperature reported was 34° at Sibley and Mason City on the 6th. The average daily maximum, 86.9°; average daily minimum, 59.4°. Average monthly maximum, 96.8°; average monthly minimum, 41.6°. Greatest monthly range, 66° at Carroll; least monthly range, 40° at Mt. Pleasant. Total range for the month, 70°.

PRECIPITATION.—Average for the State as deduced from 78 voluntary observers' reports, 2.67 inches. The greatest amount reported 6.20 inches at Sac City; the least amount reported 0.57 inches at Washington. The average number of days on which 0.1 inch or more of rain fell, 7.1; average number of cloudy days, 3.7; average number of part cloudy days, 10.5; average number of clear days, 15.8.

HALO, SOLAR—Monticello, 15th.

THUNDER STORMS—Were reported as having occurred on every day in the month except the 1st, 3d, 5th, 6th, 8th, 12th, 18th and 29th,

AURORA—Elkader, 3d.

HAIL—Mason City, 30th; Sibley, 20th, 25th; Webster City, 9th (one inch in diameter) 16th, 23d; Independence, 15th; Richland, 15th; Ovid, 30th; Mechanicsville, 26th; Audubon, 9th; Atlantic, 15th; Cedar Rapids, 16th, 30th; Belle Plaine, 15th; Alta, 30th.

HIGH WIND—Ottumwa, 9th; Osceola, 21st, 29th; Hopkinton, 23d; Iowa Falls, 20th; Larrabee, 20th, 27th; Ovid, 30th; Ames, 21st.

FOG—Osceola, 18th.

HOT WINDS—Rockwell City, latter part of the month; Algona, 30th (very hot).

LIGHT FROSTS were reported from Iowa Falls, Mason City, Hawkeye, Corning, Cresco, in low places; Atlantic, Delaware, Clarinda, Charles City, Grand Meadow and Hampton on the 6th.

Sioux City, Iowa, reported a maximum wind of 75 miles per hour from the south on the 20th.

ATMOSPHERIC PRESSURE.

STATIONS.	Mean reduced barometer.	EXTREMES.			
		Highest reduced barometer.	Date.	Lowest reduced barometer.	Date.
Cedar Rapids	29.96	30.21	6	29.60	27
Clarinda	29.92	30.27	6	29.55	27
Cresco	29.96	30.22	6	29.59	27
Davenport	29.96	30.22	9	29.69	27
Des Moines	29.95	30.22	6	29.58	27
Keokuk	29.97	30.20	12	29.68	27
Omaha (Neb)	29.94	30.28	6	29.53	27
Sioux City	29.89	30.24	6	29.50	27
Means	29.94	30.28	6	29.50	27

WIND MOVEMENT.

STATIONS.	Number of miles.	Maximum velocity.	Direction.	Date.
Davenport	5,513	45	SE	21
Des Moines	5,295	41	SW	23
Keokuk	4,905	36	W	16
Omaha (Neb)	5,816	38	SW	20
Sioux City	8,595	75	S	20

OBSERVERS' NOTES.

Clinton—DR. LUKE ROBERTS. June, 1894, was the warmest June during the last 16 years. The mean temperature was 74.2°, being 4.8° above normal. The number of days when the maximum reached 90° or above, was 16. The maximum temperature was 97°—9° above

normal. The minimum was 13°—4.1° below normal. The mean daily range was 28°—2 5° above normal. The mean temperature of the warmest day was 83.3°—2.9° above normal, occurring on the 27th. Mean temperature of coldest, 52.7°—3.2° below normal.

Rainfall 2.54 inches—2.16 inches below normal. No rain fell during the first 14 days of the month, or for the last six days of May. The number of storm days was seven, being four below normal. The number of cloudy days was only three, while normal is nine. The number of clear days was 14, being four in excess of normal. Cloudiness was only 34 per cent of the surface of the sky, while normal is 46 per cent.

The movement of the wind was 2,800 miles, or 570 miles below normal. The prevailing direction of the wind was from the west, but at no time did it blow with much force, the maximum velocity reaching only 18 miles an hour. Calms, or nearly so, were frequent.

The month was propitious for the growth of all crops, and the advancement made in immature crops was very satisfactory, and the month closed with flattering prospects of a generous harvest—especially that of corn.

During the month several fine sunset scenes were witnessed, but the most interesting phenomenon was a sunrise scene on the morning of the 30th, from 4 to 4:30. The sky was overcast with fleecy clouds, except in the western portion, where storm clouds were precipitating rain and hail 60 to 80 miles distant from this city. The clouds were made to put on varied shades of coloring from the rays of the rising sun, the most pronounced colors being red and yellow. Much of the coloring resembled the reflection from an extensive conflagration. The varied combinations and shifting scenic effects of the bright colorings I will not attempt a description, but simply say that all who saw this heavenly display pronounced it indescribably grand and beautiful.

Monticello—HENRY D. SMITH. The highest temperature recorded in Monticello in June for forty years, was 101° in 1870. Lowest on record in that month, 36°, in 1855. The highest mean for June was 74°, in 1856; lowest, 61.1°, in 1863; normal for June, 8.38°. Highest rainfall in same period for the month, 9.04 inches, in 1865; lowest, 0.74 inches, in 1857. Normal, 4.28 inches.

West Bend—P. H. DORWEILER. At 10 P. M. on the 30th of June, we noticed a hot wind from southwest. The mercury, which was 82° at 9 P. M. went suddenly up to 97°. There was a threatening storm; at 11 P. M. the thermometer indicated only 85°; next day 65°; only a trace of rain.

Cedar Rapids—H. D. OLDS. From May 25th to June 15th there was absolutely no rainfall. Showery the balance of the month. Hay and oats light. Potatoes short. Wells and streams very low. Corn never looked better.

College Springs—A. A. BERRY. Ground in very dry condition. No hay, and pastures very short. Small grain an average or above. Large acreage of corn as much of the oats crop was planted to corn. Rain needed badly.

Richland—W. A. SHAFFER. There was not a day in this month but what the sun shone more or less.

Humboldt—HENRY S. WELLS. Dry weather prevails. Corn only is not affected by it. Tame grass is too light to cut. All pasture looks like sheep pasture.

Keosauqua—JOHN H. LANDES. We have not had a general rain over the county since May 10th, although we have had neighborhood rains more or less over all parts. No storm disturbances of any kind this month.

Mason City—H. I. SMITH. Severe wind from the west and southwest at 9 P. M. on the 20th, blew down out houses and trees, and store fronts in Mason City, and sheds, barns and wind mills in the country,

SOLAR OBSERVATIONS, JUNE, 1894.—ALTA, IOWA.

BY DAVID E. HADDEN.

Date.	CENTRAL TIME.	NUMBER VISIBLE		Faculæ.	Definition.	REMARKS.
		Groups.	Spots.			
1	5:35 P. M.	5	19	3	Good.	The umbræ of the 2 larger groups N. are dividing.
2	5:15 P. M.	6	22	2	Good.	Fine jets on W. limb near the large spot; also prominence on SE. limb.
3	6:10 P. M.	8	32	3	Good.	Two small groups SE. limb. One large spot near W. limb has now but single nucleus, numerous smaller spots having taken the place of the other nuclei visible yesterday.
5	5:20 P. M.	7	24	4	Good.	New group in facula by rotation on E. limb. Two prominences on SE. limb; one W. limb.
6	5:40 P. M.	7	34	4	Good.	
7	5:10 P. M.	7	28	4	Good.	Extensive region of facula surrounding spots near E. limb S. of equator. Group of prominent facula by rotation SE. limb. Remarkable emptive prominence on SE. limb. It consisted of intensely brilliant "spikes" and "flames," which reached a height of at least 70,000 miles and underwent rapid changes, almost entirely subsiding in 20 minutes. The C line was much disturbed. Dark jets turned toward the red end of the spectrum were observed in the faculous region for some distance in on the disc.
8	5:30 P. M.	7	25	3	Poor.	New spot formed in facula SE. limb. Few prominences on SE. limb.
10	5:00 P. M.	7	20	3	Fair.	New group E. limb. Facula by rotation.
11	5:10 P. M.	7	24	3	Fair.	A new group is on edge of E. limb by rotation. Large quiescent prominence and few smaller ones on E., W. and SE. limbs.
12	5:20 P. M.	8	28	3	Good.	Extensive area of facula on SE. limb. Groups of prominences along E. and NE. limbs.
13	5:20 P. M.	9	40	4	Good.	Group of umbra and penumbra just in SE. limb. Several fine prominences along SE. and E. limbs. Small on W.
14	5:20 P. M.	9	38	4	Fair.	The group on SE. limb is fine. Small, feather-like prominence on W. limb.
16	5:40 P. M.	6	35	4	Bad.	

NOTE.—Balance of observations for June will be published next month.

BELATED REPORTS.

Fayette, for May, 1894: Mean temperature, 58.6°; mean maximum temperature, 72.3°; mean minimum temperature, 46.9°. Highest temperature observed, 88°

on 14th and 15th. Lowest temperature observed, 32°, on 28th. Total rainfall, 1 96 inches. Prevailing wind was northwest. Light frost was reported on 4th, 14th, 30th and 31st; killing, on 19th, 20th and 28th. Hail storm on the 5th.

AUGUST'S PAST WEATHER RECORD.

DES MOINES—16 YEARS' RECORD.

Temperature.—Mean or normal, 73°. The warmest August was that of 1881, with an average of 79°. The coldest August was that of 1890, with an average of 70°. The highest temperature during any August was 103°, on 17th, 1881. The lowest temperature during any August was 40°, on 24th, 1891. Average date on which the first "killing" frost occurred (in autumn), October 10th. Earliest recorded, September 12th.

Precipitation.—Average for the month, 3.33 inches. Average number of days with .01 of an inch or more, 8. The greatest monthly precipitation was 6 69 inches in 1880. The least monthly precipitation was 1.10 inches in 1886. The greatest amount of precipitation recorded in any 24 consecutive hours was 2.66 inches on 10th and 11th, 1888.

Clouds and Weather.—Average number of clear days, 13; average number of partly cloudy days, 11; average number of cloudy days, 7.

Wind.—The prevailing winds have been from the southwest. The highest velocity of the wind during any August was 63 miles on August 10th, 1893, from the southwest.

DAVENPORT—22 YEARS' RECORD

Temperature.—Mean or normal, 71°. The warmest August was that of 1881, with an average of 77°. The coldest August was that of 1888, with an average of 68°. The highest temperature during any August was 98°, on the 3d, 1887. The lowest temperature during any August was 44°, on the 8th, 1884.

Precipitation.—Average for the month, 3.73 inches. Average number of days with .01 of an inch or more, 9. The greatest monthly precipitation was 12 68 inches in 1885. The least monthly precipitation was 0.51 inches in 1873. The greatest amount of precipitation recorded in any 24 consecutive hours was 4.79 inches on the 23d, 1885.

Clouds and Weather.—Average number of clear days, 12; average number of partly cloudy days, 13; average number of cloudy days, 6.

Wind.—The prevailing winds have been from the southwest. The highest velocity of the wind during any August was 45 miles on the 10th, 1887.

KEOKUK—23 YEARS RECORD.

Temperature.—Mean or normal, 75°. The warmest August was that of 1881, with an average of 80°. The coldest August was that of 1875, with an average of 70°. The highest temperature during any August was 102°, on the 31st, 1873. The lowest temperature during any August was 47° on the 23d, 1875.

Precipitation.—Average for the month, 2.97 inches. Average number of days with .01 of an inch or more, 7. The greatest monthly precipitation was 5.98 inches in 1885. The least monthly precipitation was 0.54 inches in 1873. The greatest amount of precipitation recorded in any 24 consecutive hours was 3.90 inches on August 13, 1886.

Clouds and Weather.—Average number of clear days, 10; average number of partly cloudy days, 25; average number of cloudy days, 6.

Wind.—The prevailing winds have been from the south. The highest velocity of the wind during any August was 60 miles on the 12th, 1886, from the northwest.

METEOROLOGICAL DATA FOR JUNE, 1894.

STATIONS.	TEMPERATURE OF THE AIR (IN DEGREES FAHRENHEIT).								Precipitation in inches—Monthly.	Prevailing direction of wind.	No. of cloudless days.	No. of partly cloudy days.	No. of cloudy days.	No. of rainy days (.01 inch or more).	Hail storms.	No. of thunder storms.
	Monthly mean.	EXTREMES. Mean maximum.	Mean minimum.	Maximum.	Date.	Minimum.	Date.	Monthly range.								
Afton	74.8	90.4	59.2	99	13	42	6	57	2.15	SW	13	14	3	5	..	..
Albia	75.6	90.0	59.0	100	29	39	6	61	1.33	S	9	16	5	6	..	3
Algona	72.5	....	....	94	30	45	6	49	1.80	SW	21	8	1	3	..	3
Alta	72.7	86.4	59.0	99	30	43	5, 6	56	2.78	S	16	12	2	9	1	3
Amana	73.5	88.0	59.0	97	15, 29	39	6	58	1.73	S	20	8	2	5	..	6
Ames (Cooper)	72.2	88.4	56.1	101	19	36	6	65	3.51	SE	10	8	12	10	..	..
Ames	....	....	....	....	....	....	....	....	3.37	....	....	....	....	12	..	..
Atlantic	71.2	86.5	55.9	97	29	38	1	59	3.95	S	13	11	6	9	..	4
Audubon	72.2	86.7	57.7	96	30	37	6	59	2.88	S-SW	11	9	10	7	1	5
Belle Plaine	73.0	87.3	58.6	97	13	40	6	57	2.56	S	....	....	....	8	1	..
Bonaparte	75 0	89.9	60.0	98	28	45	7	53	1.82	SW	....	....	....	7	..	..
Carroll	72.4	83.9	57.7	101	30	35	6	66	1.51	....	15	13	2	8	..	..
Cedar Falls	73.0	87.6	58.5	95	13, 30	38	6	57	3.55	S	18	5	7	5	..	..
Cedar Rapids	74.4	85.4	63.5	94	29	41	5	53	2.43	SE	23	2	5	9	2	..
Charles City	69.4	80.6	58.3	90	13, 30	37	6	53	4.75	....	....	....	....	9	..	..
Clarinda	73.5	85.1	61.8	95	30	44	6	51	4.02	S	16	11	3	12	..	..
Clinton	74.3	88.3	60.3	97	14	55	5, 6	42	2.54	SW	14	13	3	7	..	5
College Springs	72.6	....	....	98	30	41	1	57	3.25	S	21	8	1	8	..	..
Corning	72.2	84.6	59.9	93	29, 30	39	6	54	3.59	SW	16	10	4	7	..	3
Cresco	69.4	81.6	57.1	93	13	36	6	57	3.00	S-SW	14	12	4	9	..	6
Davenport	75.0	86.3	63 6	95	13	44	6	51	2.16	SW	14	13	3	8	..	11
Decorah	70 8	84.3	56.8	100	21	36	6	64	2.64	....	20	6	4	6	..	..
Delaware	70.9	....	....	95	15	47	5	48	2.48	....	17	11	2	6	..	..
Des Moines	74 0	86.9	62.0	99	30	43	6	56	1.67	SW	18	9	3	1	..	10
Dubuque	74.5	86.9	62.0	96	14	43	6	53	2.25	S	20	6	4	9	..	..
Elkader	72.1	82.0	56.1	98	14	36	6	62	3.49	N	19	9	2	7	..	4
Emmetsburg	71.6	86.1	57.2	98	30	41	6	57	4.62	S-SW	24	4	2	9	..	2
Fairfield	74 7	89.8	59.6	98	27	35	6	62	2.14	....	....	....	....	7	..	..
Forest City	71.0	84.9	59.2	95	14	41	6	54	2.65	S	20	8	2	8	..	..
Ft. Madison	78.5	....	....	100	12	55	7	45	3.19	SW	11	15	4	5	..	5
Galva	70.1	84.3	55.9	100	30	37	6	63	2.43	S	10	16	4	8	..	..
Glenwood	76.8	90.1	63.4	104	29	43	7	61	5.24	S	12	10	6	9	..	..
Grand Meadow	70.3	....	....	90	13, 14	44	6	46	2.43	SW	8	19	3	6	..	..
Greenfield	74.5	88.9	60.9	97	30	39	6	58	2.94	SE	17	9	4	9	..	13
Grundy Center	73.0	86.9	59.0	96	20	39	5	57	2.66	S-SW	20	7	3	5	..	1
Hampton	71.5	85.5	57.5	95	19	39	6	56	2.78	SW	15	14	1	9	..	2
Hawkeye	....	....	....	....	....	....	....	....	2.27	....	....	....	....	5	..	..
Hopeville	73.6	85.6	61.5	95	30	42	6	53	3.30	S	7	20	3	7	..	8
Hopkinton	72.4	83.6	61.1	94	13	46	6	48	2.27	....	....	....	....	8	..	..
Humboldt	....	....	....	....	....	....	....	....	2.09	S	22	8	0	6	..	..
Independence	71.2	85.7	57.0	95	14	39	7	56	3.44	S	22	5	3	7	1	3
Indianola	74.5	88.6	60.3	100	30	42	6	58	1.29	S	13	11	6	7	..	5
Iowa City	74.0	86.7	61.3	95	29	46	7	49	2.40	S	1	28	1	5	..	3
Iowa Falls	69.8	83.9	55.7	94	13	37	6	57	2.85	....	....	....	....	7	..	..
Jefferson	74.6	91.7	57.6	99	30	37	6, 7	62	1.99	SE	12	11	7	4	..	..
Keokuk	76.0	88.0	64.0	96	29	44	6	51	2.95	SW	21	8	1	9	..	9
Keosauqua	76.2	89.5	62.9	97	30	42	6	55	1.87	....	....	....	....	3	..	..
Knoxville	73.7	87.9	59.5	97	29, 30	40	6	57	1.65	S	17	7	6	7	..	..
Larrabee	72.9	88.9	57.0	98	30	39	6	59	2.65	SW	10	14	6	7	..	4
Logan	75.6	91.0	60.2	102	30	40	5	62	3.75	S	21	5	4	10	..	..
Le Claire	....	....	....	....	....	....	....	....	2.54	....	....	....	....	8	..	..
Mason City	69.4	84.1	54.7	93	13, 15	34	6	59	4.77	....	10	0	20	9	..	..
Maxon	76.5	....	....	100	29, 30	54	5, 6	46	1.52	....	12	18	0	4	..	3
Mechanicsville	72.4	86.4	58.5	95	13	39	6	56	2.68	S	21	8	1	9	1	..
Monticello	72.8	85.7	59.2	94	13	40	6	54	3.03	S	23	5	2	7	..	5
Mt. Pleasant	77.3	....	....	92	28	52	5	40	1.64	SW	18	10	2	7	..	..
Newton	74.1	88.7	59.5	99	29	49	7	50	1.12	S	15	13	2	7	..	1
North McGregor	....	....	....	....	....	....	....	....	2.25	....	....	....	....	6	..	..
Omaha (Neb.)	74.0	86.0	63.1	97	30	47	6	50	4.74	SE	14	7	9	12	..	..
Osage	69.5	....	....	....	....	....	....	....	2.25	....	....	....	....	6	..	..
Osceola	74.3	86.2	62.4	94	29	40	6	54	1.91	S	9	19	2	9	..	9
Oskaloosa	73.7	87.7	59.7	95	15	38	6	57	1.61	SW	22	4	4	4	..	..
Ottumwa	76.1	87.9	....	96	29, 30	42	6	54	2.78	E	21	7	2	3	..	3
Ovid	74.7	89.6	59.8	99	30	39	6	60	1.39	SW	15	11	4	7	1	6
Panama	72.4	85.9	59 0	97	30	41	6	56	2.69	SW	21	6	3	9	..	..
Richland	74.3	....	....	....	....	....	....	....	1.78	....	7	23	0	6	1	..
Rockwell City	....	....	....	....	....	....	....	....	2.02	....	19	10	1	5	..	3
Sac City	72.8	83.9	61.7	96	30	46	5	50	6.20	NE-SW	16	10	4	4	..	..
Seymour	75.1	89.6	60.7	99	30	40	6	59	2.26	S	21	9	0	5	..	..
Sibley	69.8	86.4	53.2	95	20	34	6	61	3.34	S	18	12	0	4	2	..
Sioux City	72.0	84.8	60.4	100	30	41	6	59	2.74	S	12	12	6	10	..	..
Spirit Lake	73.1	89.8	56.6	103	30	40	6	63	1.49	NE-SE	14	11	5	7	..	..
Vinton	73.3	....	....	93	13, 29	45	6	48	2.82	SW	23	5	2	7	..	1
Washington	73.8	87.9	59.8	97	29	40	6	57	0.57	SW	....	....	....	4	..	..
Webster City	73.9	....	....	98	30	43	6	55	3.45	SE	10	20	0	5	3	9
West Bend	70.7	....	....	96	30	48	5, 8	48	2.48	S	14	12	4	7	..	..
Williams	71.8	....	....	98	30	51	5	47	2 48	S	25	3	2	9	..	..
Winterset	74.2	88 6	59.8	97	15, 30	42	6	55	3.86	S	14	7	9	8	..	..
Means	73.2	86.9	59.4	96.8	....	41 6	....	55 2	2.67	S	15.9	10.5	3.7	7.1	..	..

DAILY AND MONTHLY MEAN TEMPERATURE FOR JUNE, 1894.

STATIONS.	DATE.																													Monthly Mean.
	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	
Afton	68	72	76	70	62	60	66	68	74	76	77	79	80	80	80	70	71	72	78	82	78	79	78	73	73	78	78	80	81	74.5
Albia	68	72	76	75	61	57	67	71	72	75	76	78	79	79	78	70	71	72	77	84	80	80	78	77	73	78	80	82	81	78	75.6
Algona	70	69	68	62	56	59	70	72	71	74	79	81	80	78	78	68	68	69	71	73	73	76	75	74	72	72	80	74	79	85	72.5
Alta	67	73	70	66	55	62	68	72	71	71	77	79	80	79	77	68	72	70	72	82	70	73	76	74	74	74	77	74	78	83	72.7
Amana	64	69	70	66	58	55	64	69	72	76	78	77	78	77	80	76	70	70	76	81	80	80	80	76	72	74	76	80	78	81	73.5
Ames	65	71	71	64	60	56	66	68	69	73	74	76	78	76	78	70	71	66	79	76	76	77	76	74	74	73	78	76	76	81	72.2
Atlantic	62	66	77	75	58	56	62	69	69	74	74	77	74	76	74	68	68	64	70	80	71	72	74	72	76	76	76	75	78	79	71.2
Audubon	67	68	78	64	58	56	65	68	72	77	74	76	78	77	77	68	70	68	76	80	72	74	74	74	74	75	78	77	77	80	72.2
Belle Plaine	65	69	69	67	58	58	66	69	72	75	78	79	80	78	79	73	70	68	73	80	78	78	80	75	72	73	73	78	77	80	73.0
Bonaparte	66	70	75	69	60	56	65	70	72	77	78	80	80	78	79	74	73	70	76	87	82	78	81	78	72	76	81	86	78	81	75.0
Carroll	65	72	61	57	53	54	65	73	68	71	73	78	80	80	80	79	68	77	65	82	76	78	76	75	78	70	78	79	81	89	72.4
Cedar Falls	66	71	79	66	64	58	66	68	69	76	76	77	78	78	80	79	69	66	69	79	78	77	77	74	68	72	74	74	78	83	73.0
Cedar Rapids	66	70	72	70	54	58	64	68	74	76	78	80	78	78	78	74	68	70	78	82	82	80	80	76	78	72	80	81	82	80	74.4
Charles City	66	68	67	60	53	48	55	64	72	72	72	75	77	76	76	70	68	63	69	80	68	76	78	75	68	65	73	73	73	81	69.4
Clarinda	65	71	76	70	63	59	64	69	71	74	77	78	78	77	80	70	70	69	77	80	74	77	77	74	74	76	79	78	78	80	73.5
Clinton	66	70	72	67	57	56	66	69	72	75	78	80	79	78	83	78	71	70	72	81	80	79	82	79	76	75	78	78	78	78	74.3
College Springs	58	66	73	76	62	59	65	68	68	72	77	79	79	78	78	67	72	67	76	76	74	75	78	75	70	74	80	77	79	81	72.6
Corning	64	68	75	66	62	56	63	70	68	72	76	76	78	78	76	69	70	68	76	78	74	75	78	72	72	73	78	76	80	78	72.2
Cresco	63	68	67	62	50	54	63	68	70	70	77	77	78	76	72	70	63	63	66	76	72	74	76	71	70	69	72	74	72	78	69.4
Davenport	67	72	75	67	56	56	67	72	74	77	80	80	82	81	83	79	71	70	72	82	82	80	80	78	76	74	78	83	81	74	75.0
Decorah	64	67	72	62	52	54	62	68	72	71	78	75	79	77	75	74	66	66	66	80	80	76	78	74	70	68	73	75	74	78	70.6
Delaware	64	69	68	64	52	58	66	69	74	72	78	77	78	76	71	71	65	65	70	80	72	73	69	69	76	74	78	78	78	78	70.9
Des Moines	68	72	76	66	60	58	67	70	72	74	76	79	80	80	80	72	70	69	75	84	76	78	81	74	73	76	80	79	81	83	74.4
Dubuque	66	73	72	66	58	57	67	72	75	76	80	80	81	81	82	78	68	69	72	82	81	80	76	78	74	73	78	81	80	81	74.5
Elkader	64	69	68	62	54	56	64	68	71	76	78	76	78	78	82	74	68	70	68	80	78	77	78	76	72	72	78	76	80	80	72.1
Emmetsburg	70	76	68	65	57	63	65	69	70	69	75	77	80	78	78	66	70	66	66	80	80	74	76	74	71	74	76	74	76	80	71.6
Fairfield	...	...	...	66	60	54	63	65	73	76	79	78	79	78	78	72	73	74	79	79	80	80	83	78	72	75	80	84	78	79	74.7
Forest City	64	67	72	63	62	52	59	67	72	70	72	76	79	78	78	78	67	64	69	74	84	74	78	74	73	71	71	74	73	78	71.0
Ft. Madison	70	80	78	78	64	64	72	82	79	78	85	89	82	80	80	79	74	70	80	88	83	82	81	71	74	78	86	84	82	82	78.5
Galva	64	70	63	64	53	58	62	70	73	71	73	78	82	79	77	67	68	70	71	82	73	76	72	74	74	73	76	80	79	81	70.1
Glenwood	68	76	79	72	...	...	65	75	70	75	77	80	82	82	80	73	74	76	78	81	72	80	76	75	76	77	82	79	87	84	76.8
Grand Meadow	64	68	70	61	53	56	...	...	73	72	76	76	78	78	82	74	68	70	68	80	78	77	78	76	72	72	76	78	76	80	72.1
Greenfield	68	76	76	68	60	57	66	70	75	76	78	80	82	80	82	73	71	74	78	80	80	78	78	72	75	76	80	76	81	82	74.5
Grundy Center	68	72	66	64	58	60	68	72	72	74	77	76	79	80	80	72	63	72	76	78	78	78	75	74	68	72	77	74	81	82	73.0
Hampton	66	70	72	65	54	56	67	70	70	72	74	78	79	78	80	70	66	64	70	80	75	75	77	72	68	72	75	74	76	78	71.5
Hopeville	68	72	78	68	62	57	66	69	72	74	75	79	79	78	80	72	70	71	76	81	74	77	78	73	71	74	78	78	81	80	73.6
Hopkinton	67	71	77	66	55	58	68	71	72	74	78	78	80	78	78	75	65	69	67	78	73	75	76	73	68	68	75	78	78	78	72.4
Independence	64	69	70	64	60	56	62	67	70	72	77	77	78	77	78	75	68	66	69	78	75	74	78	73	70	70	74	76	75	78	71.3
Indianola	68	72	76	67	66	58	67	70	73	74	76	78	79	80	80	75	70	67	81	82	77	79	80	74	73	76	80	78	81	82	74.5
Iowa City	70	72	72	68	64	59	64	68	72	76	78	78	78	77	78	76	74	70	71	81	78	78	78	77	74	74	78	80	78	78	74.0
Iowa Falls	64	69	66	62	54	54	65	67	69	72	74	76	78	76	79	71	66	64	70	78	76	75	77	72	68	76	74	...	...	...	69.8
Jefferson	66	71	71	68	63	58	64	64	74	76	77	86	90	78	84	...	...	...	...	...	...	...	81	77	76	76	77	81	78	81	74.6
Keokuk	66	72	78	73	59	57	66	72	72	76	78	82	82	78	81	78	72	68	76	82	83	80	82	79	74	76	82	86	84	80	76.0
Keosauqua	68	72	77	70	62	56	67	69	73	78	80	80	79	79	78	73	74	72	78	83	83	80	80	86	83	76	77	81	87	82	76.2
Knoxville	67	72	76	68	61	57	66	70	66	74	75	76	78	78	78	72	70	69	76	82	79	78	80	76	72	78	78	80	80	80	73.7
Larrabee	62	72	67	62	55	62	67	72	72	71	78	82	81	80	78	67	72	71	73	78	72	74	78	77	74	72	77	78	81	82	72.9
Logan	71	78	74	70	58	67	76	70	74	75	78	74	80	79	81	74	74	74	74	84	76	82	78	74	78	76	80	75	78	85	75.6
Mason City	64	66	65	62	50	52	63	68	72	70	75	76	78	76	78	69	66	64	78	82	77	78	82	77	71	70	71	72	70	72	69.4
Maxon	70	72	78	74	57	60	72	74	62	74	76	80	82	81	80	71	72	72	81	84	79	83	79	77	73	76	77	81	87	82	76.5
Mechanicsville	64	70	74	70	55	54	64	66	66	71	77	78	78	79	80	76	70	71	74	78	76	76	78	74	72	71	78	78	78	77	72.4
Monticello	62	69	72	67	53	58	68	68	73	74	77	79	79	78	75	76	66	68	74	81	78	79	71	76	69	72	80	74	67	78	72.7
Mt. Pleasant	65	74	81	71	59	63	67	74	75	85	86	86	87	78	78	77	75	67	75	84	77	83	79	82	76	80	87	86	87	81	77.8
Newton	68	70	71	68	62	59	67	70	72	74	78	77	80	78	80	72	71	66	74	82	78	79	80	76	74	76	80	80	81	82	74.1
Omaha (Neb.)	69	74	76	71	62	62	68	72	68	73	76	79	80	80	78	69	74	70	74	79	76	74	72	73	75	80	82	78	82	80	74.0
Osage	64	69	66	60	52	57	60	69	68	70	74	76	78	76	72	68	64	70	69	79	71	74	76	70	68	68	74	70	74	78	69.5
Osceola	...	...	72	75	61	58	67	68	74	74	76	84	76	...	80	73	70	70	76	82	78	76	78	72	...	76	...	79	85	...	74.3
Oskaloosa	66	70	77	68	62	56	66	69	74	74	78	78	78	77	78	72	72	72	74	81	79	78	80	76	68	76	78	80	78	78	73.7
Ottumwa	71	72	76	74	59	60	70	74	71	77	80	81	80	78	79	72	73	70	78	84	77	82	80	79	72	78	85	81	82	80	76.1
Ovid	68	72	78	69	64	58	66	71	72	74	76	78	80	78	78	71	71	72	77	83	78	78	80	76	72	76	80	81	81	82	74.7
Panama	65	71	71	66	58	58	66	70	68	67	76	78	80	78	78	72	72	70	72	78	72	73	76	71	74	76	79	76	80	82	72.4
Richland	62	70	72	66	58	58	68	71	78	79	78	81	80	78	76	69	62	68	78	83	78	81	79	80	69	76	84	79	82	81	74.3
Sac City	66	72	65	60	60	62	75	76	68	78	80	80	82	80	81	67	70	70	72	70	72	70	72	72	70	72	76	76	79	84	72.8
Seymour	67	72	77	68	64	58	66	69	72	75	77	76	80	78	78	76	69	63	78	84	80	72	76	80	72	76	80	82	85	87	75.1
Sibley	66	65	72	60	52	56	64	68	70	68	74	75	76	75	72	73	68	68	69	81	67	72	73	73	71	70	76	72	74	77	69.8
Sioux City	66	70	72	62	56	58	68	71	70	70	76	79	78	79	76	69	72	70	72	74	70	72	78	73	74	73	80	77	80	84	72.0
Spirit Lake	66	70	68	64	65	62	66	73	69	71	75	82	81	81	76	70	72	70	72	76	68	76	76	74	72	77	80	80	80	82	73.1
Unionville (Mo.)	...	...	...	...	...	...	...	...	80	75	82	80	78	78	82	78	75	82	81	81	81	80	82	82	84	88	82	84	82	82	80.2
Vinton	68	72	72	65	55	54	62	72	72	78	78	80	80	80	75	77	68	68	76	82	76	78	74	76	67	70	81	76	80	80	73.3
Washington	65	71	73	66	59	56	64	70	72	76	80	80	81	78	78	73	70	68	73	81	80	78	80	78	72	74	79	82	80	80	73.8
Webster City	70	72	70	65	57	58	71	70	70	69	76	82	80	77	78	70	72	76	82	74	72	74	75	78	75	72	74	78	78	82	73.9
West Bend	68	73	64	63	52	60	64	69	69	70	78	79	80	77	76	66	65	67	68	74	72	73	74	70	60	71	77	74	76	83	70.7
Williams	66	69	64	64	53	65	69	71	74	78	79	80	80	80	81	73	70	68	77	78	74	72	70	74	72	76	78	76	80	83	71.6
Winterset	66	72	78	69	62	60	68	70	73	75	79	80	80	80	81	73	70	68	77	78	76	78	80	74	72	76	78	76	80	80	74.2

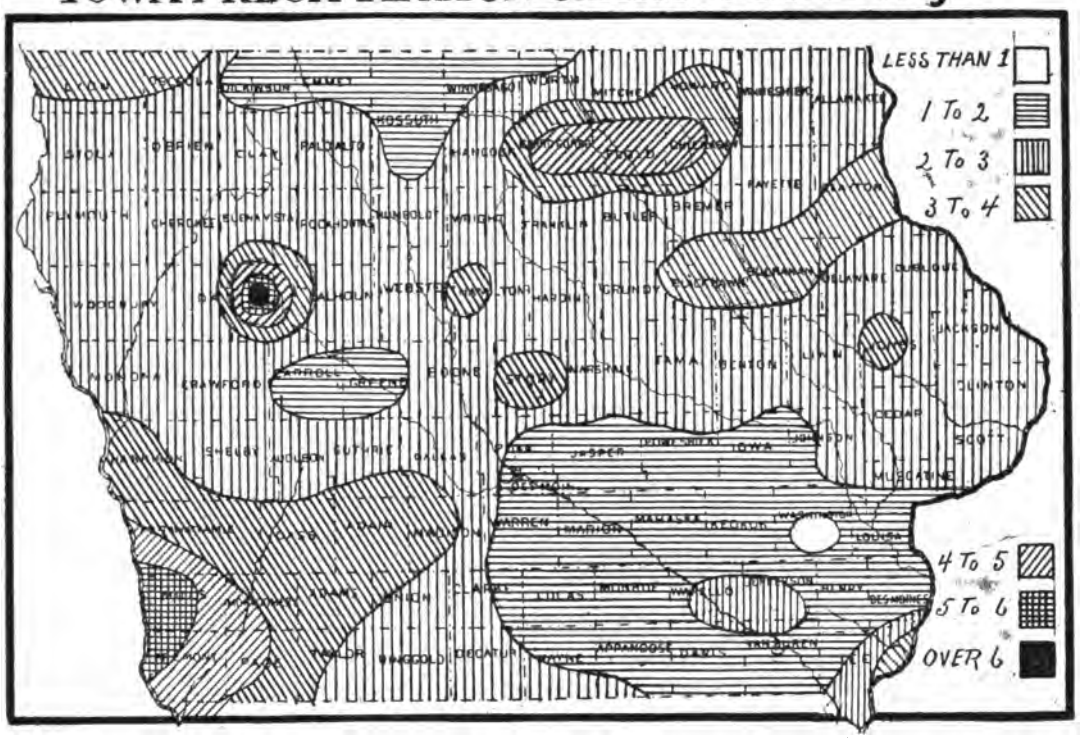
MAXIMUM AND MINIMUM TEMPERATURE FOR JUNE, 1894.

| STATIONS. | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | | 9 | | 10 | | 11 | | 12 | | 13 | | 14 | | 15 | | 16 | | 17 | | 18 | | 19 | | 20 | | 21 | | 22 | | 23 | | 24 | | 25 | | 26 | | 27 | | 28 | | 29 | | 30 | | Mon'y Mean. | |
|---|---|---

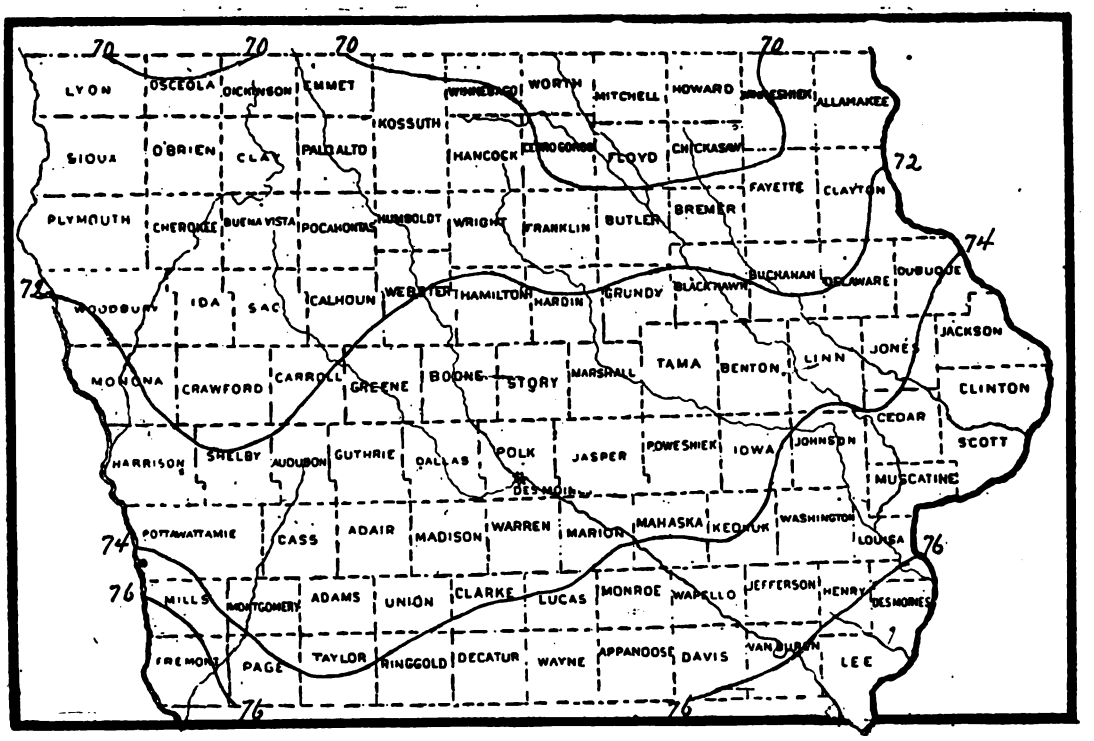
DAILY AND MONTHLY PRECIPITATION FOR JUNE, 1894.

STATIONS.	DATE. 1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	Total.
Afton	....	....	....	T	....	....	....	....	0.33	....	....	....	....	....	....	1.00	....	....	....	....	....	0.25	....	0.20	....	....	....	....	0.37	....	2.15
Albia	....	....	....	....	T	....	....	....	0.48	T	....	....	....	....	....	0.03	....	....	....	....	0.23	....	0.08	T	0.08	....	T	....	....	0.43	1.33
Algona	....	....	....	....	....	....	....	....	....	....	....	....	....	....	T	0.32	....	....	....	T	0.38	....	....	0.60	....	T	....	....	....	....	1.30
Alta	....	....	T	0.01	....	....	....	....	....	....	0.02	....	....	....	0.04	0.15	....	....	0.27	1.25	0.04	....	0.68	....	....	0.52	....	....	....	....	2.78
Amana	....	....	....	....	....	....	....	....	....	T	T	....	....	....	....	T	0.65	0.13	....	....	....	....	T	0.35	....	0.41	....	....	....	0.20	1.73
Ames (Iowa Agricultural College)	....	....	....	....	....	....	....	....	0.19	....	0.05	....	....	....	0.12	0.18	0.06	....	....	0.13	....	0.06	2.50	....	0.07	....	0.15	....	....	....	3.51
Ames (Experimental station)	....	....	....	....	....	....	....	....	0.17	....	0.05	....	....	....	0.13	0.18	T	....	....	0.14	0.03	0.05	2.36	0.01	0 06	....	0.14	....	....	....	3.37
Atlantic	....	....	....	T	....	....	....	....	0.47	....	....	....	....	....	0.50	0.33	....	....	0.73	....	0.34	....	1.03	0.04	T	....	....	....	0.34	0.17	3.95
Audubon	....	....	....	0.15	....	....	....	....	0.45	....	....	....	....	....	....	0.25	....	....	0.38	....	0.47	....	1.05	....	....	....	....	....	0.13	....	2.88
Belle Plaine	....	....	....	....	....	....	....	....	0.15	T	....	....	....	T	0.72	0.07	1.01	....	....	....	0.21	....	0.20	....	0.15	....	....	....	....	0.05	2.56
Bonaparte	....	....	....	....	....	....	....	....	....	0.03	....	....	....	....	0.13	0.20	....	....	....	....	0.79	0.05	....	....	0 22	....	....	....	0.40	....	1.82
Carroll	....	....	....	T	....	....	....	....	0.26	....	0.06	....	....	....	T	0.32	....	0.02	0.28	0.02	....	....	0.75	....	T	....	....	....	....	....	1.67
Cedar Falls	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1.90	....	....	....	....	0.02	0.70	....	0.90	....	....	....	....	0.03	3.56
Cedar Rapids	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.08	1.03	0.16	....	....	....	0.06	0.13	0 28	....	0.22	0.12	....	....	0.35	2.43
Charles City	....	....	....	T	....	....	....	....	0.02	....	1.16	....	....	....	0.73	0 13	1.06	....	0.15	0.03	T	....	1.09	....	....	0.38	....	....	T	....	4.75
Clarinda	....	....	....	....	0.02	....	....	....	0.60	....	....	....	....	....	....	1 00	....	0.04	0.04	....	0.53	....	....	1.07	0.40	....	....	....	0.32	....	4 02
Clinton	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1.33	0.37	0.66	....	....	0.32	0.68	....	0.03	....	0.37	0.10	....	....	....	....	2.54
College Springs	....	....	....	....	0.06	....	....	....	0.53	....	....	....	....	....	....	0.47	T	0.09	....	....	0.59	....	....	1.02	0.34	....	....	....	0.12	....	3.25
Corning	....	....	....	0.07	....	....	....	....	0.59	T	....	....	....	....	T	0.37	....	....	....	....	0.25	....	....	1.03	0.25	....	T	....	1.01	....	3.57
Cresco	....	....	....	....	....	....	....	....	T	....	....	....	T	....	0.88	0.41	0.44	....	....	....	0.10	....	0.12	0.36	0.17	0.46	0.06	....	....	....	3.00
Davenport	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.01	0.08	1.15	....	....	....	....	0.32	0.22	....	0.04	....	0 25	....	....	0.09	2.16
Decorah	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.57	0.39	....	....	....	....	....	....	0.22	0.15	0.16	1.15	....	....	....	....	2.64
Delaware	....	....	....	....	....	....	....	....	....	T	....	....	....	....	0.40	0.35	1.20	....	....	....	0.16	....	....	....	0.13	0.24	....	....	....	....	2.48
Des Moines	....	....	....	T	T	....	....	....	0.01	T	T	....	....	T	0.30	0.01	0.09	....	0.05	T	0.21	....	0.01	0.74	0.07	....	....	0.02	....	0.16	1.67
Dubuque	....	....	....	....	....	....	....	....	....	0.15	....	....	....	....	0.09	0 42	0.72	....	....	....	....	0.32	0.26	....	0.20	0.03	0 06	....	....	....	2.25
Elkader	....	....	....	T	....	....	....	....	....	T	....	....	....	....	0.50	0.05	1.56	....	....	T	0.72	0.12	T	....	0.47	0.07	....	....	....	....	3.49
Emmetsburg	....	....	....	....	....	....	....	....	....	....	0.01	....	....	....	T	1.62	....	....	0.08	0.38	0.02	....	1.42	0.99	0.05	0.05	....	....	....	....	4.62
Fairfield	....	....	....	....	....	....	....	....	0.04	....	....	....	....	....	0.08	0.45	....	0.10	....	....	....	....	0.31	....	0.13	....	....	....	....	1.03	2.14
Forest City	....	....	....	....	....	....	....	....	0.22	....	....	....	....	....	0.25	0.35	....	....	....	0.24	0.26	0.39	0.22	0.72	....	....	....	....	....	....	2.65
Fort Madison	....	....	....	T	....	....	....	....	0.10	....	....	....	....	T	T	1.10	T	....	....	....	1.21	....	T	T	0.03	....	....	....	....	0.75	3.19
Galva	....	....	....	0.02	....	....	....	....	T	....	0.07	....	....	....	T	0.36	....	....	0.51	....	0.75	....	0.09	0.45	....	0.18	....	....	....	....	2.43
Glenwood	....	....	....	....	....	....	....	....	1.04	....	0.15	....	....	....	....	1.07	....	....	0.40	....	0.80	....	....	1.19	0.22	....	....	0.18	0.19	....	5.24
Grand Meadow	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.72	....	1.06	....	....	....	....	0.18	....	....	0.32	0.15	....	....	....	....	2.43
Greenfield	....	....	....	0.10	....	....	....	....	0.25	....	....	....	....	T	0.02	0.08	0.18	....	0.34	T	0.37	....	....	0.89	0.31	....	T	....	....	0.40	2.94
Grundy Center	....	....	....	....	....	....	....	....	....	....	....	....	....	....	T	0.05	....	....	....	T	0.42	....	2.03	....	0.10	0.06	....	....	....	....	2.66
Hampton	....	....	....	....	....	....	....	....	0.38	....	0.03	....	....	....	0.03	0.38	0.45	....	....	0.03	....	0.15	1.23	....	....	....	0.04	....	....	....	2.78
Hawkeye	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1.31	....	....	....	0.43	....	0.14	....	....	0.30	....	0.06	....	....	....	2.21
Hopeville	....	....	....	T	....	....	....	....	0.02	....	....	....	....	....	....	0.26	0.02	....	T	....	1.39	....	....	0.38	0.09	....	....	....	....	0.12	2.30
Hopkinton	....	....	....	....	....	....	....	....	....	0.05	....	....	....	....	0.05	....	0.05	....	....	....	0.50	....	0.60	....	0.35	0.07	....	....	....	....	2.27
Humboldt	....	....	....	....	....	....	....	....	0.08	....	....	....	....	....	0.01	0.41	....	....	T	0.14	0.02	....	....	1.43	T	....	....	....	....	....	2.09
Independence	....	....	....	....	....	....	....	....	T	....	....	....	....	0.20	0.75	0.33	.70	....	....	....	0 08	T	T	....	0.35	0.03	....	....	....	....	3.44
Indianola	....	....	....	T	T	....	....	....	T	0.04	....	....	....	....	....	0.01	0.05	....	T	....	....	T	0.30	0 33	0.28	....	....	0.28	....	....	1.29
Iowa City	....	....	....	....	....	....	....	....	....	T	....	....	....	....	T	....	1.25	....	....	....	0.06	....	0.84	....	0.09	....	....	....	....	0.16	2.40
Iowa Falls	....	....	....	....	....	....	....	....	0.11	....	0.15	....	....	....	T	0.49	0.25	....	....	T	....	0.10	1.49	....	0.26	....	....	....	....	....	2.85
Jefferson	....	....	....	T	T	....	....	....	....	0.17	....	....	....	....	....	....	....	....	....	....	....	....	0.10	1.55	T	....	....	T	....	....	1.99
Keokuk	....	....	....	....	T	....	....	....	....	0.18	....	....	....	0.18	....	0.04	0.72	....	....	....	0.20	0.21	....	....	0.60	0.14	....	....	....	0.58	2.85
Keosauqua	....	....	T	T	....	....	....	....	T	T	....	....	....	T	T	T	0.32	....	....	....	0.80	....	T	T	T	T	....	....	....	0.75	1.87
Knoxville	....	....	....	T	....	....	....	....	0.28	0.27	....	....	....	....	T	T	....	....	T	....	0.12	....	0.05	0.09	0.13	....	....	....	....	0.71	1.65
Larrabee	....	....	....	....	....	....	....	....	....	....	0.02	....	....	....	0.10	0.08	....	....	0.75	0.71	....	....	0 51	....	....	0.48	....	....	....	....	2.65
Logan	....	....	....	0.21	....	....	....	0.32	....	....	0.44	....	....	....	....	0.17	....	0.07	0.23	0.21	0.29	....	1.47	....	....	....	....	....	....	0.34	3.75
Le Claire	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.24	0.33	0.14	0.42	....	....	0.10	....	....	0.02	0.18	1.11	....	....	....	....	2.54
Mason City	....	....	....	....	....	....	....	....	1.00	....	....	....	....	....	0.10	1.57	0.35	....	....	....	0.08	....	0.65	0.94	0.03	0.05	....	....	....	....	4.77
Maxon	....	....	....	....	T	....	....	....	0.50	T	....	....	....	....	T	....	....	....	....	....	0.25	....	T	....	0.25	....	....	....	....	0.52	1.52
Mechanicsville	....	....	....	....	....	....	....	....	....	0.10	....	....	....	....	0.01	0.02	0.27	....	....	....	0.27	....	0.86	....	0.10	0.75	....	....	....	0.30	2.68
Monticello	....	....	....	....	....	....	....	....	....	0.10	....	....	....	....	0.64	....	0 63	....	....	....	0.64	....	0.77	....	0.16	....	....	....	....	....	3.03
Mt. Pleasant	....	....	T	....	....	....	....	....	....	....	....	....	....	....	0.34	....	0.15	....	....	....	0.33	....	0.13	0.02	....	....	....	....	....	0.67	1.64
Newton	....	....	....	T	....	....	....	....	0.13	....	....	....	....	....	....	0.14	T	....	....	....	0.18	....	0.09	0.04	0.15	T	....	....	....	0.39	1.12
North McGregor	....	....	....	....	....	....	....	....	....	.05	....	....	....	....	1.13	0.29	....	....	....	....	0.24	T	....	....	0.36	....	....	....	....	....	2.25
Omaha, Neb	....	....	....	T	0.02	....	....	....	0.50	....	0.42	....	....	....	0.09	0.48	....	0.21	0.12	0.04	1 03	....	0.27	0.77	....	0.09	....	....	....	0.79	4.74
Osceola	....	....	....	T	0.08	....	....	....	0.11	T	....	....	....	T	....	0.03	0.14	....	....	T	0.67	....	0.08	0.38	0.06	....	....	....	....	0.34	1.91
Osage	....	....	....	....	....	....	....	....	0.21	....	0.03	....	....	0.06	0.19	....	0.89	....	....	T	T	0.10	0.15	0.68	T	0.01	0 03	....	....	....	2.35
Oskaloosa	....	....	....	T	....	....	....	....	0.36	....	....	....	....	....	....	T	T	....	T	....	T	....	0.22	....	1.18	....	....	....	0.87	....	1.61
Ottumwa	....	....	....	T	....	....	....	....	0.38	....	....	....	....	....	T	T	1.40	....	....	....	T	....	T	....	T	....	....	....	....	1.00	2.78
Ovid	....	....	....	....	0.01	....	....	....	0.17	....	....	....	....	....	....	0.07	....	....	....	....	0.25	T	0.10	0 39	....	....	....	....	....	0.40	1.39
Panama	....	....	....	0 22	....	....	....	....	0 40	....	0.11	....	....	....	T	0.33	....	....	0.33	0.32	0.13	....	0.80	....	....	....	....	....	....	0.05	2.69
Richland	....	....	T	T	....	....	....	....	0.06	....	....	....	....	....	0.21	....	0.48	....	....	....	T	....	0.35	....	0.03	....	....	....	....	0.65	1.78
Rockwell City	....	....	....	....	....	....	....	....	0 03	....	....	....	....	....	....	0.54	....	....	0.06	....	0.35	....	1.04	....	....	....	....	....	....	....	2.02
Rock Rapids	....	....	....	....	....	....	....	....	1.00	....	....	....	....	....	0.10	1.67	0.35	....	....	....	0 08	....	0.65	0.04	0.03	0.05	....	....	....	....	4.77
Sac City	....	....	....	T	....	....	....	....	....	....	T	....	....	....	0.25	0.50	....	....	....	....	1.70	....	....	3.75	....	....	....	....	....	....	6.20
Seymour	....	....	....	....	T	....	....	....	0.53	....	....	....	....	....	T	T	....	....	....	....	0.50	....	0.13	T	0.40	....	....	....	....	0.40	3.26
Sibley	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	T	....	....	0.09	0.65	T	....	....	....	2.06	1.04	....	....	....	....	3 84
Sioux City	....	....	....	0.25	0.02	....	....	....	0.01	....	0.01	....	....	....	....	T	....	....	0.75	0.63	0.19	....	....	0.24	0.33	0.20	....	....	....	T	2.74

IOWA PRECIPITATION CHART JUNE 1894



MEAN TEMPERATURE JUNE 1894.



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From the following, weekly and monthly reports of Meteorological data are received by the Iowa Weather and Crop Service.

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Albia (Maxon)	Gus Johnson.
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Alta	D. E. Hadden.
Amana	Conrad Schadt.
Ames (Exp. Station)	W. H. Heileman.
Ames	Fred L. Kent.
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Audubon	J. F. Hooker.
Belle Plaine	H. W. Vandike.
Blakeville	James Rodgers.
Bonaparte	Hon. B. R. Vale.
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Cedar Rapids	H. D. Olds.
Centerville	Prof. H. E. Reister.
Charles City	J. W. Smith.
Clarinda	A. S. Van Sandt.
Clinton	Luke Roberts.
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Corning	John W. Bixby.
Cresco	Gregory Marshall.
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Postville	F. L. Williams.
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Winterset	Will McKnight.
West Bend	Phil. Dorweiler.
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*U. S. Weather Bureau.

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Met 217

UNITED STATES DEPARTMENT OF AGRICULTURE
WEATHER BUREAU.

MONTHLY REVIEW

OF THE

Iowa Weather and Crop Service.

VOL. V. —JULY, 1894.—NO. 7.

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CENTRAL STATION, DES MOINES, IOWA.

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DIRECTOR.

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LOCAL FORECAST OFFICIAL,
U. S. WEATHER BUREAU, ASS'T DIRECTOR.

DES MOINES:
G. H. RAGSDALE, STATE PRINTER.
1894.

THE IOWA WEATHER AND CROP SERVICE

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U. S. Department of Agriculture---Weather Bureau.

MONTHLY REVIEW

OF THE

IOWA WEATHER AND CROP SERVICE.

VOL. V.] JULY, 1894. [No. 7.

IOWA CROP REPORT, AUGUST 1, 1894.

SUMMARY OF REPORTS FROM OVER EIGHT HUNDRED CORRESPONDENTS OF THE WEATHER AND CROP SERVICE.

Estimates of crop condition and yield have been received from over 800 correspondents, representing every county in the State. They were generally mailed on or before August 1st, at a time when local showers and weather conditions gave promise of an early breaking of the drouth which had prevailed with great severity through the months of June and July. The reports were based upon the prospect of speedy relief, which has not been realized. In fact there has been a steady decline in the condition of all unharvested crops, in the larger part of the State, since August 1st.

The reports placed the average condition of crops as follows:

Corn, 40 per cent; flax, 53; millet, 88; broom corn, 47; sorghum, 54; Irish potatoes, 37; sweet potatoes, 46; apples, 58; plums, 58; grapes, 57.

Threshing returns and estimates show following average yield of harvested crops. Winter wheat, 18; spring wheat, 14; rye, 17; oats, 25 bushels per acre.

If these figures are sustained by the final returns this State will have over one hundred million bushels of oats of good quality, and 11,000,000 bushels of wheat.

EDITORIAL NOTES.

Farmers should sow rye plentifully now for fall feed.

***

Wait till the clouds roll in, has been the burden of the song this season; and it has been sung in a minor key.

***

July 26, 1894, will be referred to in future years as the date of the great hot wind storm in the Northwest. It established a record that is likely to remain unbroken for an average lifetime.

A Nebraska farmer discovered, by accident, that millet seed is an excellent feed for pigs. The value of millet has never been fully appreciated.

***

Dr. E. D. Whitacre, of Marshalltown, recalls that in 1886 there was a remarkable local drouth in Liscomb township, Marshall county, no rain falling from May 16 to August 15, a period of three months. That doubtless was as severe a drouth as any part of Iowa ever experienced or is likely to experience. Yet there was a good crop of small grain, straw being short, and about a half a crop of corn. In what other state is there a soil with such a reserve power as that? Iowa as a state is now passing through such a drouth as occurs only once in generations, although it is hardly possible it can be as severe as the local one in Liscomb township eight years ago. Yet even in that event we would have crops that would be thought bountiful in many other states. The Iowa soil holds a great moisture in reserve for periods of drouth and when the heavens become parched and as brass the grain and forage plants suck up their drink from below. Crop failures are impossible here.—*Marshall Times-Republican.*

***

In his report for August 1, Mr. Edwin Hummer of Unity, Johnson county, writes: "Most of the stock water in this section is pumped out of two inch tube wells, varying in depth from 75 to 225 feet. There seems to be an inexhaustible supply of water below the blue clay bed With a windmill on such a well, and a reservoir to hold eight days' supply, there is no such thing as scarcity of water here."

***

The professional rainmakers are gradually extending the time limits of their contracts. They began with three days, then extended it to five, and in this year of unprecedented long-time-between-showers they have, in some places, contracted to bring rain within ten days or no pay. They are sharp at a bargain.

***

"Wheat and corn," says Prof. Wilson, "can be compounded into a ration fit for any animal."

The Adams County *Union*, reports that the firing of a brick-kiln in that section was followed by a local shower, and the conclusion is reached that the heat and moisture generated thereby caused the precipitation. Thus it is that people confound coincidence and consequence. By the same rule it may be figured out that church picnics and camp-meetings cause rainfall, for they certainly come in conjunction very frequently. The heat and moisture sent into the atmosphere by a single brick kiln would not be sufficient to cause a shower big enough to irrigate a quarter-acre garden patch. The steam engines and brick kilns of Des Moines pour forth in the air every working day fifty times as much heat and moisture as the amount generated by the Adams county brick kiln, which is reputed to be such a marvelous rain-maker. And yet the Des Moines factories and brick kilns have not been able to break the drouth!

***

SIOUX CITY JOURNAL—The people of Rockwell City were considering the advisability of employing one of the numerous "rainmakers" to pump vile smelling stuff into the clouds, and one prudent business man sought and obtained from the government weather bureau at Washington an opinion on the subject. This is what the acting chief of the bureau wrote:

□ "You ask an opinion in regard to the production of rain by artificial means, and I can assure you that the weather bureau has enough evidence on this subject to justify the conclusion that no rain whatever has thus far been produced, or induced, by the so-called rainmakers. Every rainfall claimed by them, thus far, has turned out to be a natural rain, the probability of whose occurrence could have been forseen by the help of the daily weather map. You will get just as much rain in your neighborhood, and just as soon, if you wait for the natural rain instead of paying the rainmaker."

***

Showers have been like angels' visits this season—few and far between. The people should appreciate these blessings when they come.

***

The Garden Grove *Express* says: "We believe that if there had been a good sized pond of water on every quarter section of land in Decatur county we would have had rain before this. The evaporation from that much water surface could not fail to have an influence on the humidity of the atmosphere. The government holds out inducements for setting out trees on government lands for this purpose, and we think that the state of Iowa could afford to make a small rebate of taxes for each pond which kept a water surface of not less than six square rods the year round. It may be that we over estimate the benefits that would ensue, but the experiment is well worth trying. It would certainly do as much good as exploding a lot of dynamite to precipitate moisture which is not there to precipitate.

***

The editor of the Des Moines *Capital* has solved the problem relative to the cause of the drouth. He says it is occasioned by a lack of rain. There have been tomes written about the matter that do not so completely get at the core of the question.

***

The State Fair officials are making great efforts to make the coming exhibition a notable success. The attractions will certainly not be wanting, and chief among them will be the speed track. Some of the finest horses on the turf have been entered. The fair opens August 31st.

RAIN-MAKING DOWN TO DATE. I.

J. R. SAGE IN MIDLAND MONTHLY.

Can we make it rain? is the modern counterpart of the question propounded by the writer of one of the oldest books of Hebrew literature—"Hath the rain a father?" In all the ages there have been claimants to paternity of the rainfall, but despite their efiorts to prove the relationship there has remained a cloud upon their title. There are serious difficulties in the way of establishing the claim, for the rains descended before these pluvious professors began the practice of their arts, which fact gives basis for at least a suspicion that it would have rained just the same if they had never been born.

The ancient rain-fakirs performed incantations, and impressed the credulous by claiming to have sufficient influence with their dieties to produce showers at will. The latter-day pluviocrats profess to have penetrated the secret of nature's process of distillation, whereby they are able at will to set in operation the forces that cause the downpour. By shrewdly timing their work, giving five or six days' range to the "at will," they have to some extent captivated the popular mind; but those who have thoughtfully studied nature's methods, and mastered even the rudiments of meteorological science, are most skeptical concerning all such claims.

So it may be quite positively asserted that down to date there are no visible indications that nature is about to retire from the rain-making business, or that any part of the job is to be sublet by contract. Nature has ample forces employed in that kind of work, and none of them are known to be out on a strike. The sun runs the pumping machinery, working on full time, lifting in its diurnal course millions of tons of water, converting it into vapor and sending it inland upon the wings of the wind. The boreal blasts, commingling with the vapor-laden winds from seaward, form the rain-clouds, those "wandering cisterns of the air," which are swept into the vortex of the cyclone, carried across the continent and made to drop their watery contents upon the thirsty earth.

The gigantic forces of nature employed in the production of even a moderate shower are infinitely above the grasp and even beyond the comprehension of man. Those who have given life-long study to the movements of the elements and the laws governing their action have barely learned the alphabet of the subject, and the very terms employed in its discussion but serve to illustrate the illimitable expanse of the unknown. They have learned enough, however, to know that these vast forces can only be wielded by the power of the Omnipotent. As an illustration of what is termed the thermo-dynamics of the

atmosphere, as related to the production of violent storms, a noted French scientist, H. Mohn, made a careful estimate of the energy expended in the passage of a notable West Indies cyclone, which lasted three days and nights, and the conclusion reached was that the force developed was fully equal to that of four hundred and seventy-three million horse-power, or at least fifteen times the power that is produced in the same space of time by all the windmills, turbines, steam engines, and all the men and animals on the surface of the globe. "Whence comes this colossal force?" he asks, and the answer is: "From the latent heat of vapor which rises in the center of the hurricane and is there condensed."

Applying this method of computation to mid-continent cyclonic movements with which the people of this region are familiar, some most astounding results will be reached. Suppose, for illustration, a storm is developed of sufficient extent and force to yield to the state of Iowa an average of one inch of rainfall. To produce this, the area covered by the "low" in its movement across the valley must be from three to five times the extent of the area of precipitation, for it should be known that to obtain even a moderate amount of moisture you must milk a vast expanse of sky. On the average the area of rainfall in this portion of the continent does not exceed one-fifth of the territory covered by the cyclone. All parts of this area feel the effects of the passing storm; but only a fraction thereof receives benefit of the rainfall. There is a vast sweep in the circulation of winds employed in the work of wringing out a purely local shower. And the sum total of energy employed in the production of rainfall to the extent herein described would be more than equal to the motive power required to operate all the machinery of the world for an equal length of time. To fully illustrate and demonstrate the dynamic theory of storms would require much space and some very intricate mathematics.

It will be seen from the foregoing that when any man undertakes, by the employment of any known mechanical or chemical forces, to produce rain at will, to cover even a square mile of surface, he assumes a very large contract. And in view of the infinite resources of nature, and the vast scope of operation of the forces engaged in pumping the waters from the sea and pouring them out upon the land, the conclusion must be reached that the man who assumes the title of Nature's Assistant Rain-maker is practicing upon the credulity of the public.

Rainfall is the most variable element of climate. This variability is not in the sum total of precipitation the world over; for the sun's heat is a constant, and the process of evapofation is going on continually and all the waters that rise in vapors must pass through the counter process of condensation. But there is great inequality in the distribution of rainfall. The hyetal charts of the world, graphically representing the annual rainfall in shades, show very black and very light belts and spots in all portions of the earth. There are rainless regions in close proximity to regions of perpetual greenness. Some of the islands of the ocean present a strange contrast—on one side of a mountain a rainless, barren desert, and on the other side a very Eden of tropical luxuriance, with copious and unfailing rains. This marked inequality is caused by the topography of the countries where it is observed, and no human agency can change the course of rain-bearing winds, or equalize the deposit of moisture.

In all mid-continent regions there is marked variability in the rainfall of different seasons. The seasons of abundance and of deficiency sometimes come in groups or series, like the fat and lean kine in Pharoah's dream. And in the same season one portion of a state may be scorched by drouth while another section is blessed with an abundance of moisture. Every year some portion of this great valley suffers from drouth, while other portions receive excessive downpours. The total amount of precipitation over this continent varies but little year by year, but local extremes are of yearly occurrence.

The present season affords a marked illustration of inequality in the distribution of moisture. Reversing the the usual order, Kansas has received a much greater supply than Iowa, and Colorado's quota of moisture has exceeded Kansas. The northwestern coast states were swept by floods, and the eastern states were drenched, while the states on a line from the Dakotas to Georgia were browned by drouth.

It is much easier to find the cause of this irregularity than to prescribe an effective cure. The Gulf of Mexico is the thermal fountain whence is drawn the larger part of the rainfall which waters this and contiguous states in the Mississippi valley. The currents of humidity from that source have this year been deflected and precipitated elsewhere, while Iowa and the other drouthy states went dry. That has been the chief cause of the shortage. The cyclones or "lows" were squeezed dry before they crossed the Missouri. There have been abundant signs and portents of rain all through the season; but the old weather proverb that all signs of rain fail in a dry time has been fully verified.

Some of the old Bible writers were shrewd observers of the weather. In Ecclesiastes ii: 3, we read; "If the clouds be full of rain they empty themselves upon the earth." And Job said: "They (the clouds) pour down rain according to the vapour thereof." That's good sense and sound meteorological science. When the clouds are full of rain they empty themselves of moisture when brought under the right conditions as to temperature; that is, when subjected to dynamic cooling. But after they have been wrung dry they vanish into thin air and disappear. When the watery vapor is not in the air no process of pounding or squeezing will bring down rain

It is not a matter of hypothesis, but a demonstratable fact that in this drouthy period the percentage of relative humidity of the air has been unusually low. The records of the United States Weather Bureau station in Des Moines prove indubitably that the drouth was in the air, the relative and absolute humidity being so low at all hours of the day and night that no moisture could be wrung from the arid skies. Here are a few sample figures

June 7, relative humidity at 7 A. M., 53 per cent; temperature, 56 degrees; dew-point, 39 degrees; fall in temperature necessary to produce dew, 17 degrees. Same date, 7 P. M., humidity, 21 per cent; temperature, 81 degrees; dew-point, 38 degrees; fall in temperature necessary to produce dew, 43 degrees. To produce rain from such arid atmosphere the temperature must be suddenly lowered from 81 to below 38 degrees, and that would produce a frost following the rain.

The mean relative humidity of the air during the first fifteen days of June (A. M. and P. M. observations) was 47.5 per cent; average dew-point, 48 degrees; average fall necessary to produce due, 23 degrees.

These figures illustrate the difficulty in the way of rain-making by nature's process. Due credit must be given to nature, for making heroic efforts to that end. There were the usual reactionary periods, and the elements passed through all the throes and changes incident to the month of our heaviest rainfall, but the rains came not because the atmosphere did not contain the vapor. As Job says, "The clouds pour down rain according to the vapour thereof." They did that this season, but they were rather short on vapor.

The monopolists of Kansas, Colorado and the Eastern states robbed Iowa of its just quota of moisture. We must make our appeal to Congress. That would be as effectual a remedy as the attempt to cure the defect by dosing the skies with chemical gases through a stove-pipe hole in the top of a freight car!

The arid atmosphere does not thirst for gas, but cries continually, "Water! water!" Give it an abundance of vapor, apply the dynamic cooling process and it will water the earth copiously. So, to create a fresh supply of vapor, it would be more rational to start the tea-kettles boiling over a million fires than to administer a dose of gas.

Meantime, until man has attained sufficient power to grasp and wield the infinite forces of nature, whereby he can, at will, change the mighty currents of ocean and atmosphere, and thereby make a more equal distribution of moisture, we had better reverently adopt the motto engraved upon our silver dollar—"In God we Trust."

THE GREAT DROUTH.

J. R. SAGE, IN THE HOMESTEAD.

This is a peculiar season. As a matter of fact all seasons are peculiar, in that no two are exactly alike. But this season has been so far off from the ordinary run as to be unique and unprecedented in may respects. It opened earlier than usual, with most glorious promise. March came in wrong end first, beginning with ethereal mildness and ending with zero and blizzards. Farmers plowed, sowed, planted gardens the first half of the month, and rejoiced in the belief that the zone had slipped a cog to the southward. The last of the month they shivered over fires or went out with overcoats and mittens, and saw the opening buds of tender plants frozen solid.

April was warmer than the average, with plenty of moisture, making it an ideal month for farm work and seeding operations. May brought phenomenal extremes of temperature, the general range being from ninety degrees down to the most damaging freeze ever known in this section at that stage of crop growth. This was a discouraging setback, but if favorable conditions had followed it would have been one of the best of seasons. But the most disastrous feature of the season thus far has been the great drouth, which is likely to become historic. Certainly it is entitled to rank as a record-breaker, for this section never experienced such a season for aridity at this time of the year. Beginning early in May, it steadily maintained its withering grasp. Though most promisingly "broken" on several occasions, yet it declined to stay broke, and resumed business at the old stand. This state has been the center of its greatest severity, but in its scope it has embraced a considerable part of the corn belt, and stretched from the Dakotas to Georgia.

The records of the central station of the Iowa Weather Service, at Des Moines, Iowa, furnish some striking figures, illustrating the shortage of moisture in this region. The total precipitation (rain and melted snow) for the year ending June 30, was 18.55 inches, a little more than one-half the average annual amount. During the corresponding twelve months in 1892-3, the total was 33.59 inches, and in the calendar year 1892 the amount was 38.42 inches.

The rainfall at Des Moines in May this year was 1.41 inches; in June, 1.67 inches, and in July, to the 20th inst., .25 of an inch, making a total of only 3.33 inches in nearly three months. The normal rainfall for that period (two months and twenty days) is 12.47 inches, showing a deficiency of 9.14 inches. So, it appears that within the past three months we have had only about one-fourth of our normal amount of moisture.

Added to this shortage of rainfall there has been a notable deficiency in the relative humidity of the air, so that dews as well as rains have been light and infrequent. In the months of May and June the mean relative humidity was only 54.6 per cent, or about 20 per cent below the normal amount. This general dryness of the air has greatly intensified the drouth. The hot winds have been thirsty, drinking up all moisture within reach. The result has been a general lowering of the water level in the earth far below any former period on record, and serious damage to crops. Streams and deep wells never before destitute of water have gone dry. Stock water has never been so scant as now, and in the larger part of the "burnt district" pastures are as brown and bare of feed as they have usually been in any winter month. The tame hay crop, though secured in the best of order, is not more than 45 per cent of an average in amount. Oats are likely to yield about half an average in three-fourths of this State. In the other fourth they may show better returns. In quality and weight they will be better than last year, and may bring more money. Barley is very light, and spring wheat has been cut short. Flax will be a very light crop. Corn has shown marvelous vitality throughout this unprecedented season, and despite all adverse conditions it gave promise on the first of the month of a more than average crop, but at this writing.

July 23d, it has reached a critical stage, and without timely rains the yield will be generally light, and in the most arid districts very nearly a total failure. The season has demonstrated the wonderful vitality of corn, and also the marvelous qualities of our soil in withstanding drouths, but neither the one nor the other can quite hold up under furnace heat and desert dryness.

Are we to infer from the experienc of this summer and the past year that this country is going dry? By no means. You may safely bank on the statement that the general average rainfall will be as steadily maintained in the coming twenty years as it has been in the past forty years. There will be years of excess and years of scarcity, but all the laws of nature and Providence stand unrepealed and secure. As long as the winds blow and the waters flow, and the sea gives off its vapor, so long will the rain refresh the earth.

Rainfall is the most variable element of climate, as to localities and seasons, but the yearly precipitation over the whole earth is quite uniform. Every year brings excess somewhere, and in every season some section of our wide country suffers from drouth. The tendency of nature is to bunch its watery favors, and every section passes through seasons of scarcity and of over abundance. This season has brought the full average quantity of rainfall, but it has been unequally distributed. To them that had plenty has been given an excess of moisture, and from them that were parched with drouth was taken even the little water that remained. We may fret and growl at the inequality, but we can't help ourselves.

This section has occasionally been visited by extremes of aridity and of saturation. The dry and wet seasons seem to come in groups or series, though not with such regular order that we may give a certain forecast of their coming. The years 1886 and 1887 brought severe drouths to the western and northwestern states. In 1890 the month of July was characterized by periods of intense heat, with high winds and drouthy conditions, producing a blighting effect upon all vegetation, and the drouth was unbroken through the larger part of August, cutting short the late maturing crops.

Drouths and floods were as frequent in the early days in the west and northwest as in the last two decades, and they were more severely felt in pioneer periods because of the isolation and poverty of the early settlers. They depended wholly upon one or two staple crops, and when they were cut short there were pinching times in the cabins and dugouts.

Our latter day farmers have a greater diversity of crops, and no drouth, flood, hail or wind storm is likely to knock them all out. Another fact should be noted here, viz.: The corn belt can produce bigger crops of corn in dry than in wet seasons. This has been proven many a time within the last fifty years. There is a measure of truth in the old saying: "In dry seasons people are scared to death, and in wet seasons they are starved to death."

There have been drouths and drouths in this country, and some of them became historic. The most prolonged and disastrous visitation of that kind within the last half century occurred in July, August and September, 1881, affecting nearly the whole country east of the Mississippi river. During July and August it was also severe in Kansas and Arkansas. The rainfall was from one-eighth to one-fourth the normal quantity and the heat was correspondingly intense As a result wells, springs and streams, that had never before gone dry, were exhausted, and rivers went below the low water mark. Water was so scarce that factories were shut down, and on some of the railroads freight trains were delayed by lack of water for the engines.

That was the season when Iowa and other portions of the northwest were nearly drowned out. In 1881 the records at Des Moines show a total rainfall of 15.79 inches in June; 5.57 inches in July; 5.29 inches in August, and 4.70 inches in September; making a total of 31.35 inches in the four months, June 1st to September 30th. There is little wonder that some portions of the country went dry when nature was so prodigal of its watery stores in this region. And the fact should be noted that in the wet season of 1881 the yield of merchantable corn and small grain in this State was less than in the drouthy seasons of 1886, 1887 and 1890.

DRY WEATHER PHILOSOPHY.

The Homestead.

Experience and observation prove that in this latitude drouthy seasons occur at intervals of varying length, and that they can neither be prevented by human agency nor cured by any known system of rain persuasion.

Well, what shall we do about it? For one thing we ought to endure patiently the ills we cannot cure, trusting that in the order of Providence these alternations of wet and dry are designed for human weal. Possibly by close study we may find that all the extremes to which we are subjected—heat and cold, wet and dry, storm and calm—are essential to the conservation of nature's forces and the maintenance of the elements of production. We may at least see that these extremes serve as checks upon overproduction and soil-robbing. We are not likely to glut the markets with our soil products in such seasons as the one we are just now "enjoying."

Another lesson of the drouth is this, it suggests the wisdom and necessity of hoarding the products of bountiful seasons. The story of Joseph's gubernatorial rule in Egypt will serve to illustrate the point. Our farmers should carry over a larger share of the products of the fat years to provide for possible shortage in the lean ones, which are sure to come at intervals. It has been estimated that on June 1st the amount of corn in the producers' hands was only 16 per cent of last year's crop. Everybody now wishes it had been 30 per cent; and year by year that proportion should be carried over. Of oats they had only 11 per cent, when the amount would better have been 25 per cent.

As our western farmers become well-to-do they will prepare safe storage for a larger proportion of the surplus products of abundant seasons, and by that means they will steady the markets, maintain better prices, and have something on hand to tide them over the sands and

strands of drouthy seasons. To this end close economy should be practiced in the flush seasons, with the certain knowledge that sooner or later there will be a shortage. Only in case of absolute necessity should a bushel of corn be sold at prices near the cost of production.

Another lesson of dry seasons is the value of tile draining, thorough culture and keeping the surface in the best possible condition to conserve moisture. One has but to use his eyes and reasoning faculties in a season like the present to see that the best crops are raised on the best drained and most wisely cultivated fields. There are plenty of object lessons in sight just now. And we may also learn the value of the deep-rooted, leguminous plants in preparing the soil to do its best in such time of need. The assertion may be ventured that, other conditions being equal, the best corn will be gathered this season from soil that has been liberally clovered in recent years. That farmer is in great luck who, this year, has a liberal sized patch or field of sowed or drilled corn, or other fodder plant, to supplement the burnt out pastures. It is not luck, either, but wise forethought, that makes such provision for the mid-summer shortage of pasture. Every year brings a period when milch cows, especially, would be benefited by daily feeds of sweet corn or other succulent stuff from the truck patch, and in a season like this a soiling crop is indispensable.

This year is likely to attest anew the value of corn stover, and the necessity of saving every blade and stalk of the corn fields. There will be as much feeding value in the fodder as in the grain.

This season has reduced the supply of stock water to its minimum, and impressed upon farmers the necessity of storing surplus moisture, or drawing from the deeper fountains within the earth. In many portions of the state artesian flows can be obtained by drilling a few hundred feet, and one good flowing well might be made to serve a number of farms. All farmers can construct reservoirs for storage of the surplus storm waters which fall at some time in every season. A well constructed pond, so situated that it may receive the flow from the drains, should hold sufficient water to withstand the severest drouth.

Last, but not least, the great economic value of timber belts and forests is attested in seasons like this. The dense forests and groves are great conservators of moisture, and, by breaking the force of hot winds, they prevent the rapid evaporation of moisture from adjoining fields. And the trees, through their deep roots, and by the pores of their leaves, yield an immense amount of moisture to mitigate the severity of drouths. There is more vapor given to the air from an acre of dense timber than from an equal area of lake or ocean surface. Without assuming the untenable ground that forests increase the rainfall in prairie regions like this, it may be easily demonstrated that they possess a very high economic value in conserving moisture, maintaining the flow of streams, and equalizing the humidity of the atmosphere near the earth's surface. Therefore, with all thy planting, fail not to plant trees, and keep on planting in the by-places for the generations to come. And thy children's children shall rise up and call thee blessed.

CONSERVING MOISTURE.

BY PROF. JAS. WILSON.

Bulletin 32 of the Minnesota station has an article on this subject that is timely. Physicists estimate that the soil should have from one-third to a half of its saturating capacity to best grow plants. It was found that sub-soil four inches deep June 29 had 24.30 per cent of water where it was mulched three inches with oat chaff, 19 2 per cent where it was cultivated, and 18.1 per cent where it was not cultivated. On July 25 a mulched vineyard had 18.3 per cent water in a gravelly soil in the surface soil. The soil in an oat field at the station had only 3.8 per cent moisture.

Mulching can be resorted to by gardeners, but it is not practical for general farmers. Cultivation is the only resort while crops are growing; but so pressing is this subject that all methods within reach whereby we can hinder evaporation should be studied and adopted. A rational system of rotation that will restore humus to the soil is an evident method of conserving moisture, consequently lands should be reseeded to clover and the grasses periodically. Our rotations too often embrace a long series of years. Two crops of corn and one a nurse crop for the grasses, with two years of grass growing, would reintroduce humus to the soil by grass roots. All farmers have observed how much more vigorous corn grows on sod land; the reason is, the mechanical condition is better and the soil in better condition to contain moisture. There is, perhaps, no expedient to which farmers can resort to put western lands in the best possible condition to retain moisture and resist drouths than a rotation of crops so short that the soil will not lack this class of humus so essential in conserving soil water. The proper cultivation of the soil is another important expedient or necessity. Spring plowed sod land not thoroughly pulverized dries out and is not a good conservator of moisture. As near the mulch condition as sod can be reduced is the ideal state of surface soil, be the system of farming what it may. The fields of Iowa this year tell on their owners. If the plow has not been kept going the crop shows that evaporation has got away with the soil water. Windbreaks are mentioned by the Minnesota station as helping to save moisture. The evaporation that goes on is in ratio to the velocity of the winds. This favors windbreaks around our fields, something we have always advocated for other reasons. We notice in many localities that the willow hedges are being cut down. They will be replanted, or something else, when the necessity of fighting cold winds in winter and the dry winds in summer, is fully realized. Moisture is the great transportation system of the plant, and when it ceases there is a strike in growth.

In the history of Iowa there has never been a drouth so severe as this, and it is not probable that another of the same sort will be seen in a life-time.

The wise farmer will this year save all his corn fodder, and grow fall pasturage by a liberal seeding of rye.

THEORIES OF OUR CLIMATE.

PROF. D. A. KENT, IN RURAL LIFE.

The intensely dry weather of this year and the comparatively dry weather of recent years has led many to venture assertions that there were permanent changes in climatic conditions which would forever modify the quantity of moisture in the soil and therefore the humidity of the atmosphere. It has been claimed that the water table is sinking, that the wells are drying up, and that drainage and the cutting of timber are the causes of the recession of waters in the soil. If any one who has been thinking in this line will stop and widen his views a little he will certainly change his mind. The changes that civilization has made on the prairies of Iowa have been favorable to rainfall rather than unfavorable. There have been as many trees planted and permitted to grow as have been cut down. The smoke of village and town and country dwelling and factory and railway locomotive sets free more moisture every year than all the prairie grass and little groves of the whole state could conserve even in the days when they afforded shelter and comfort alone to the aborigines. The effect of tile is to make land drier in wet times and wetter in a dry time. The proof of this is evidenced in the condition of the undrained wet land this year. The spots which are ordinarily wet show the greatest suffering of crops, unless they have been specially handled to suit the conditions of the year.

There are no wells giving out except those supplied by surface water or very small sand pockets. Watkins' well, near Story City, which at a depth of sixty-five feet throws a six-inch column of water twenty feet into the air is still flowing with undiminished force. And all the artesian wells, so far as I have heard, are still pouring out their complement of water. The little basin that affords water for our college and farm is drawn on for three times as much water as in former days, yet an attempt to lower the well sunk in the basin's edge resulted only in getting down three feet further, notwithstanding two 2-inch and one 3-inch pump was applied. The water table of this basin is within six feet of the surface in places.

The future has just as much rain for Iowa as the past, and such will continue to be the case until there is some great surface modification. When nature lifts a great chain of mountains somewhere in the upper Mississippi then might we expect climatic change. But as long as Lake Okoboji continues to lie higher than the highest peak of the Ozark mountains the weather clerk will continue to send out the same kind of bulletins.

It has been only thirteen years since the whole state of Iowa was so wet that about all one could say of the country was that it was too thick to swim and too thin to wade.

We know but little of Iowa weather farther back than fifty years. But the configuration of the prairies show that there has always been a limited rainfall. The surface and soil conditions show that the rainfall has always been distributed as it is now. That is, the most rain falls in the southeast, and the quantity gradually diminishes as the surface of the State rises, or as we approach the northwest. In this light rainfall lies the hope of our country.

The intensely dry year has famished many of the fungus plants that infest our crops, and has hindered the development of certain insect life. And I would just as soon set the year down as an unknown blessing, as to pass it to any other account. Were we to have double the amount of rainfall that we now enjoy in Iowa it would not be but a few years until the last vestige of the black mould that now constitutes Iowa's greatest luxury, would be washed away, and the Iowa farmer would stand with that forlorn look that now characterizes the southern planter as he pines for enough soil to cover his seed, and then pines again for enough fertilizer to make it grow. Nature did a good job when she made Iowa. She never intended that the great State should either dry up or wash away. She tolerates a little pinching of a man's vanity through the drouth and drowns his pride in an occasional freshet, but on the whole there is a fine equilibrium in the Iowa climate.

SOME RAINFALL FIGURES.

Secretary Browne, of the Des Moines Commercial Exchange, has recently made some interesting figures illustrating the thermodynamics of the atmosphere and rainfall. Below are some of the results:

"A rainfall of one inch amounts to 5.2 pounds of water per square foot, or 226,512 pounds—113¼ tons—per acre. If we have an area 576 square miles in Polk county, a rainfall of one inch would give 83,501,383,680 pounds—41,750,691 tons of water. This would not be much of a shower. Not infrequently two or three inches fall in about as many hours.

"The precipitation from a shower may be regarded as so many pounds of the vapor of water suspended in the sky, or as so many pounds of condensed vapor—water—spread upon the ground. If we are to have such a shower, 41,750,691 tons of vapor must overhang Polk county. It becomes vapor by means of the heat of the sun.

"The theoretic, calorific value of the best anthracite coal is the vaporization of fifteen pounds of water per pound of combustible—while our average steam boilers do not exceed eight pounds of water vaporized per pound of coal.

"If the vapor for Polk county showers were to be furnished by our steam boilers the coal required would be 5,218,836 tons, and the number of 100 horse power boilers would be over 2,000,000—working during ten hours, or over 6,666 boilers working 300 days.

"If this much vapor is to fall as rain this much heat must be removed from it. These two processes are necessary, the vaporization by heating and the condensation by chilling. The sun does the heating; what does the chilling? Some of the heat is taken up by air almost unthinkably cold, some is doubtless converted into electric energy, and some gives force to the winds. Who shall wonder at the old question, 'Who can stand before His cold?'

"If we assume that an evaporation of thirty pounds of water under pressure furnishes one horse power per hour, as is claimed by the builders of our best boilers and engines, and that 300 pounds would yield one horse power

per day of ten hours, then, having a regard for difference between evaporation in open air and evaporation under pressure, our Polk county shower may be dynamically expressed as the work of 269,359,302 horse power during ten hours. This seems adequate to equip a tornado.

"If we assume that in the manufacture of artificial ice one pound of coal is required for three pounds of ice, then our Polk county shower may be frigorifically represented by 15,656,509 tons—513,113,207 cubic feet of ice—a cube about 800 feet square, something of a stumbling block for the rain makers.

"Researchers do not agree whether anything more than simply the chilling of atmospheric vapor is necessary to produce rainfall. Even the rain-makers, successful as they claim to be, maneuver under variant theories.

"These conclusions are startling, and almost past belief to the writer, though he has verified the computations. They suggest that the heat is quite as wonderful as the cold of the glacial ages.

"The shortage of precipitation at Des Moines, from March 1 to July 18, is 11.46 inches, or 478,462,928 tons of rain for Polk county."

SEPTEMBER'S PAST WEATHER RECORD.

DES MOINES—SIXTEEN YEARS' RECORD.

TEMPERATURE—Mean or normal, 64°. The warmest September was that of 1884, with an average of 69°. The coldest September was that of 1883, with an average of 60°. The highest temperature during any September was 95°, on the 6th, 1893. The lowest temperature during any September was 31°, on the 27th, 1889. Average date on which first "killing" frost occurred (in autumn), October 10th. Earliest recorded, September 12th.

PRECIPITATION—Average for the month, 3.12 inches. Average number of days with .01 of an inch or more, 9. The greatest monthly precipitation was 7.98 inches, in 1886. The least monthly precipitation was 0.15 inches, in 1882. The greatest amount of precipitation recorded in any 24 consecutive hours was 2.92 inches, on September 25th, 1880.

CLOUDS AND WEATHER—Average number of clear days, 12. Average number of partly cloudy days, 11. Average number of cloudy days, 8.

WIND—The prevailing winds have been from the southwest. The highest velocity of the wind during any September was 44 miles, on September 29th, 1878, from the southwest.

DAVENPORT—TWENTY-THREE YEARS' RECORD.

TEMPERATURE—Mean or normal, 71°. The warmest September was that of 1881, with an average of 70°. The coldest September was that of 1883, with an average of 60°. The highest temperature during any September was 96°, on the 7th, 1893. The lowest temperature during any September was 33°, on the 27th, 1889. Average date on which first 'killing" frost occurred (in autumn), October 14th.

PRECIPITATION—Average for the month, 3.26 inches. Average number of days with .01 of an inch or more, 9. The greatest monthly precipitation was 7.86 inches, in 1874. The least monthly precipitation was 0.80 inches, in 1871. The greatest amount of precipitation in any 24 consecutive hours was 4.49 inches, on September 18th and 19th, 1874.

CLOUDS AND WEATHER—Average number of clear days, 11. Average number of partly cloudy days, 2. Average number of cloudy days, 7.

WIND—The prevailing winds have been from the southwest. The highest velocity of the wind during any September was 72 miles, on the 7th, 1872.

KEOKUK'S TWENTY-THREE YEARS' RECORD.

TEMPERATURE—Mean or normal, 66°. The warmest September was that of 1881, with an average of 73°. The coldest September was that of 1890, with an average of 60°. The highest temperature during any September was 97°, on the 5th, 1881. The lowest temperature during any September was 33°, on the 27th, 1889. Average date on which first "killing" frost occurred (in autumn), October 14th.

PRECIPITATION—Average for the month, 3.68 inches. Average number of days with .01 of an inch or more, 9. The greatest monthly precipitation was 11.08 inches, in 1876. The least monthly precipitation was 0.49 inches, in 1891. The greatest amount of precipitation recorded in any 24 consecutive hours, was 4.89 inches, on September 7, 1876.

CLOUDS AND WEATHER—Average number of clear days, 11. Average number of partly cloudy days, 3. Average number of cloudy days, 7.

WIND—The prevailing winds have been from the south. The highest velocity of the wind during any September was 38 miles, on the 19th, 1884.

JULY WEATHER REPORT.

July, 1894, has beeome historic, breaking all previous records and making one of its own as the dryest month ever experienced in Iowa. The mean temperature was 76.4°, which is 2.3° above the normal for the State. The average precipitation was 0.63 of an inch—3.67 inches below the normal amount. Over three-fourths of the State received less than half an inch of rain during the month, and a number of localities reported only a trace. The greatest amount reported was 3.50 inches at Centerville.

The culminating period of the drouth was on the 25th, 26th and 27th, during which the wind attained a high velocity and the temperature was expressed in three figures.

At Des Moines, on the 26th, the maximum temperature was 104°, and the wind reached the velocity of 34 miles an hour. The highest temperature reported was 109° at Sprit Lake on the 26th and 27th.

The air was exceedingly dry throughout the month. At the Central Station the mean relative humidity for July was 46 per cent, or about 26 per cent below normal. In July, 1892, it was 78 per cent.

The following table gives, as a basis for comparison, the mean temperature and total precipitation for the month of July in the years from 1872 to 1894 inclusive:

YEARS.	MEAN TEMPERATURE, DEGREES.					PRECIPITATION, INCHES.				
	Des Moines.	Davenport.	Keokuk.	Omaha.	Sioux City.	Des Moines.	Davenport.	Keokuk.	Omaha.	Sioux City.
1872	....	76	78	76	....	.....	3.80	6.77	6 36	.....
1873	....	75	76	75	....	.....	2.37	7.73	4.24	.....
1874	....	78	80	80	....	.....	3.10	4.61	0.54	.....
1875	....	74	76	74	....	.....	3.36	12.70	10.01	.....
1876	....	75	77	75	....	.....	4.82	6.79	7.30	.....
1877	....	75	77	76	....	.....	3.42	7.06	0.96	.....
1878	....	78	81	78	....	.....	2.18	2.37	7.66	.....
1879	78	77	80	78	....	0 29	5 87	1.98	3.17	.....
1880	74	74	78	76	....	3.82	4.31	2.25	5 36	.....
1881	76	78	79	80	....	5.57	0.51	3.08	5.89	.....
1882	68	70	72	71	....	4.78	4.41	4.53	6.76	.....
1883	74	74	76	76	....	2.37	3.66	3.15	4.79	.....
1884	72	72	74	76	....	2.16	4.51	2.30	10.35	.....
1885	76	76	79	78	....	6.55	1.66	2.29	9.24	.....
1886	78	76	78	78	....	0.27	0.43	0.65	0.69	.....
1887	78	78	80	77	....	1.94	3.09	1.57	2.02	.....
1888	76	74	77	79	....	3.42	7.31	6.06	2.56	.....
1889	74	74	75	75	76	4.37	8.25	6.78	4.94	3.31
1890	77	76	78	79	76	1.10	0.85	2.49	3.74	2.59
1891	69	69	71	72	69	2.78	3 29	2.77	3.54	5.77
1892	74	74	75	76	75	8.64	4.16	6.18	6.34	2.63
1893	76	77	78	77	75	3.55	1.75	2.60	3.03	2.29
1894	78	77	78	77	76	0.29	0.44	0.37	0.61	1.81
Means	75	75	77	76	74	3.24	3.83	4.26	4 89	3 07

SUMMARY OF WEATHER CONDITIONS.

BAROMETER:—Mean pressure for the month 30.00 inches. Highest observed 30.21 inches at Clarinda, Des Moines and Omaha on the 2nd. Lowest observed 29.62 inches at Sioux City on the 26th. Range for the State, 0.59 inches.

TEMPERATURE:—Monthly mean as deduced from 75 voluntary observers' reports 76 4°. Highest monthly mean 82.7° at Centerville. The lowest mean 72.6° at Sibley. The highest temperature reported 109° at Spirit Lake on the 26th and 27th. The lowest temperature reported was 39° at Galva on the 14th. The average daily maximum was 91.5°. The average daily minimum was 61.3°. The average monthly maximum was 104.1°. The average monthly minimum was 50.0°. The greatest monthly range was 67° at Galva. The lowest monthly range was 38° at Ft. Madison. Total range for the State during the month was 70°.

RAINFALL:—Average for the State as determined from 79 voluntary observers' reports was 0.63 inches. The greatest amount reported was 3.50 inches at Centerville. The least amounts reported were traces at Webster City, Newton, Knoxville and Independence. The average number of days on which .01 inch or more rain fell was 2.6; average number of cloudy days, 1.4; partly cloudy, 7.8; clear, 21.9.

HALO, SOLAR:—Hopeville, 27th and 28th; Des Moines, 4th, 11th and 13th.

HALO, LUNAR:—Greenfield, 12th.

HAIL:—Hampton, 19th; Humboldt, 19th; Keokuk, 24th; Centerville, 19th.

AURORA:—Belle Plaine, 1st; Delaware, 1st; Cresco, 1st, 7th, and 26th; Clinton, 1st; Alta, 1st and 7th.

FROST, LIGHT:—Cresco, 7th.

Thunder storms were reported at some points in the State on the 1st, 5th, 6th, 13th, 18th, 19th, 20th, 22nd, 23rd, 24th, 26th, 27th, 28th, 29th, 30th, 31st.

ATMOSPHERIC PRESSURE.

STATIONS.	Mean reduced barometer.	EXTREMES.			
		Highest reduced barometer.	Date.	Lowest reduced barometer.	Date.
Cedar Rapids	29.97	30.16	9	29.80	23
Clarinda	30 02	30.21	..	29.77	...
Cresco	29.98	30.19	8	29.78	26
Davenport	30.00	30.18	8	29.79	24
Des Moines	30.01	30.21	2	29.78	23
Keokuk	30.01	30.19	8	29.84	24
Omaha (Neb)	30.01	30 21	7	29.73	27
Sioux City	29.97	30.18	2	29.62	26
Means	30.00	30.21	2	29.62	26

WIND MOVEMENT.

STATIONS.	Number of miles.	Maximum velocity.	Direction.	Date.
Davenport	4,858	25	SW	12
Des Moines	5,160	34	SW	26
Keokuk	4,562	48	W	28
Omaha (Neb)	5,393	28	S	26
Sioux City	7,252	38	NE	31

OBSERVERS' NOTES.

Clinton—DR. LUKE ROBERTS: For the few days before the close of July, 1894, everybody seemed to be impressed with the idea that this was the hottest July they ever knew—"never saw anything like it." Perhaps a reference to the records will help to correct our memories: July, 1894, was not the warmest during the last 16 years in Clinton. July, 1881, gave an average of 75.1 degrees; 1887, 76.4 degrees; 1890, 75.2 degrees; 1893, 76 degrees; while the record for July, 1894 is 75 degrees. It will be seen that the warmest July was in 1887; and on the 16th day of that month was the highest daily mean temperature of any July day during the last 16 years. The mean temperature for this day was 86.5 degrees. The mean for the warmes of July, 1894, was 83.5 degrees, occurring on the 26th and 27th. The maximum temperature for July, 1894, was 100 degrees, occurring on the 24th and on the 26th In July, 1886, the maximum temperature was 100.5 degrees; 1887, 104; 1888, 101 degrees.

Notwithstanding last July did not "beat the record" on high temperature, yet it furnished a great number of very warm days, much sunshine, a minimum number of cloudy days, and a deficiency in precipitation which beats the record. On the evening of the 19th and morning of the 20th rain fell to the amount of .21 inch, and on the 28th .18 inch more, making a total of .39 inches for the month. This is the total precipitation from the 26th of June to the close of July. While May was quite liberal in rainfall June was much below normal, so that July was without a fountain to draw from, the result being the most severe and protracted drouth experienced in this locality within the last sixteen years. July, 1890, furnished only .40 inch of rain, but a higher per cent of cloudiness, and in June preceding the precipitation was 6.50 inches, the last storm day being on the 30th.

On eighteen different days the maximum temperature

was 90 degrees or above. In July, 1887, 21 such days occurred, and six of these went above 100 degrees. July, 1886, also furnished 21 such days. The minimum temperature for July, 1894, was 46 degrees —2.5 degrees below normal. The mean maximum was 91 degrees and mean minimum 59.7 degrees

The run of wind was about normal, making 2,270 miles.

The maximum velocity was only 13 miles an hour, and the prevailing direction from the southwest. There was but little wind movement at night. Calms were so prevalent and of long duration that the aggregate number of hours in which there was no perceptible movement of the wind amounted to 165, or over one-fifth of the entire month. The 26th and 27th were the two hottest and severest days of the month, and to add to the already damaged condition of immature crops, a hot wind prevailed, which took the remaining life out of corn in some localities. In this county the effect of these winds was not so marked as farther west. Winds attaining a velocity of 35 miles an hour were reported from portions of the State during these two hot days, but in this locality the maximum velocity did not exceed nine miles an hour.

At the close of the month we find pastures dry and valueless, and the feeding of stock a necessity. Corn and potatoes plead in vain for relief, and their value to the tiller of the soil is rapidly diminishing from day to day.

The interest in the great drouth has so absorbed the attention of every one, that no ordinary phenomenon attracts attention. In fact there was but little else worthy of special mention, very little thunder and lightning, and one short exhibition of northern lights on the evening of the 1st. The water in the Mississippi river almost reached its low water mark.

Cresco—GREGORY MARSHALL: July, 1894, has been the hottest and dryest ever known here, and 105° is the highest temperature reached in that period. The corn is half killed already, with prospect of further damage if drouth continues. Grass seed sown last spring is all lost.

Glenwood—SETH DEAN: No thunderstorm at Glenwood during July. The most severe drouth ever known here.

Newton—A. LUFKIN: At this point we are 12.17 inches short of the normal rainfall up to July 31st, 1893, which makes 1,380 tons of water per acre less than the rainfall for the same time in 1893.

College Springs—A. A. BERRY: Too much sunshine and altogether too little moisture. Corn cannot make an average of over five bushels per acre and much of it will not make fodder. The 26th we had a regular Kansas hot wind that did inestimable damage. Wheat turning out well, some going as high as 43 bushels per acre and testing 62 to 65 pounds per bushel.

Cedar Rapids—H. D. OLDS: Hot weather and no rain to amount to anything sums up the months record. Crops dried up and stock suffering for want of feed and water, is the only thing to be said.

BELATED REPORTS.

FAYETTE (June, 1894)—Mean temperature, 72 2°; maximum temperature 97° on the 13th and 14th; minimum temperature 35° on the 6th. Total rain, 1.80 inches; .01 inch or more rain fell on four days. Number of cloudy days, 4; part cloudy, 13; clear, 13. Light frost on the 6th damaged grapes considerably.

SUTHERLAND (June, 1894)—Mean temperature, 71.9°; maximum temperature 100° on the 30th; minimum temperature 39° on the 6th. Total rain, 3.12; wind (prevailing direction) south. Clear days, 6; partly cloudy, 23; cloudy, 1; .01 or more rain fell on ten days. Hail on 23d.

METEOROLOGICAL DATA FOR JULY, 1894.

STATIONS.	TEMPERATURE OF THE AIR. (IN DEGREES FAHRENHEIT)								Precipitation in inches—Monthly.	Prevailing direction of wind.	No. of cloudless days.	No. of partly cloudy days.	No. of cloudy days.	No. of rainy days (.01 inch or more).	Hail storms.	No. of thunder storms.
	Monthly mean.	EXTREMES.						Monthly range.								
		Mean maximum.	Mean minimum.	Maximum.	Date.	Minimum.	Date.									
Afton	77.8	93.4	62.2	107	26	53	15	54	0.96	SW	12	7	12	3	..	..
Albia	77.8	94.9	60.8	104	26	47	7	57	0.73	S	14	15	12	3	..	..
Algona	76.5	.....	.....	104	26	60	4	44	0.25	NW	12	8	1	3	..	1
Alta	76.7	91.6	61.8	106	26	50	7	56	0.39	S	24	7	0	5	..	3
Amana	75.8	91.5	60.0	104	26	47	7	57	0.98	S SW	25	6	0	2	..	3
Ames (Hellman)	.....	.....	.....	.....	.....	.....	.....	.....	0 04	.....	.....	.....	.....	.....	.....	.....
Atlantic	74.0	90.9	57.2	104	26	43	7	61	1.23	S	17	12	2	3	..	1
Audubon	75.8	91.7	60.0	104	26	45	7	59	0.86	S	11	16	4	2	..	2
Belle Plaine	76.2	93.0	59.4	106	26	46	7	60	0.08	S	21	9	1	1	..	2
Bonaparte	72.2	95.9	60.4	107	24	46	22	61	0.19	.....	.....	.....	.....	.....	.....	.....
Carroll	75.2	92.6	57.9	108	26	65	5	43	1.73	.....	25	4	2	1	..	..
Cedar Falls	76.6	93.0	60.2	105	26	47	7	58	...	NW	31	0	0	0	..	0
Cedar Rapids	76.1	.....	.....	10o	26	57	7	43	0.18	S	27	4	0	2	..	..
Centerville	82.7	96.3	69.1	107	26	50	1	57	3 50	SW	25	5	1	4	..	..
Charles City	73.2	87.2	59.2	100	26	45	7	55	1.19	NW	.....	.....	.....	.....	.....	.....
Clarinda	76.3	88.6	64.0	100	26	56	15	44	0.41	S	23	6	2	3	..	..
Clinton	75.4	91.0	59.7	100	24, 26	46	7	54	0.39	SW	23	6	2	2	..	..
College Springs	76.9	91.2	62.6	104	26	54	6	50	0.44	S	27	3	1	4	..	..
Corning	74.7	82.2	61.5	100	26	50	15	50	3 30	SW	25	4	2	4	..	..
Cresco	74.2	89.4	59.0	105	26	44	7	61	0.09	SW	28	3	0	3	..	3
Davenport	77.0	89.3	64.5	100	26	54	22	46	0.44	SW	16	10	5	1	..	2
Decorah	73.9	90.3	57.6	104	26	44	7	60	0.48	.....	29	0	2	4	..	..
Delaware	75.0	.....	.....	104	25	48	22	56	0.11	NW	26	5	0	2	..	..
Des Moines	77.7	90.7	64.7	104	26	52	7	52	0.29	SW	23	7	1	4	..	5
Dubuque	77.1	90.8	63.3	102	26	50	7	52	0.02	N	28	1	2	1	..	..
Elkader	74.5	93.8	55.2	106	26	42	22	64	0.16	N	24	7	0	2	..	..
Emmetsburg	75.1	90.8	59.4	106	26	50	6	56	0.47	S SW	28	3	0	4	..	1
Fairfield	76.6	93.0	60.2	104	24	49	22	55	0.07	NW	8	20	3	2	..	..
Forest City	74.3	90.3	58.3	105	27	49	6	56	0.50	S	28	2	1	4	..	..
Ft. Madison	80.9	.....	.....	100	26	62	22	38	0.38	Sw Nw	15	12	4	3	..	3
Galva	74.0	91.9	56.1	106	26	39	14	67	1.12	SW	12	14	5	3	..	..
Glenwood	80.0	93.9	66.0	106	26	56	15	50	0.37	S	23	6	2	2	..	..
Grand Meadow	74.3	.....	.....	100	26	56	21	44	0.45	Sw Nw	6	25	0	1	..	..
Greenfield	77.5	92.4	62.6	104	26	49	7	55	0.57	S	19	11	1	3	..	2
Grundy Center	74.9	89.9	60.0	105	26	46	6	59	0.09	SW	20	11	0	2	..	..
Hampton	75.7	91.0	60.4	104	26	47	7	57	0.70	SW	22	9	0	2	1	..
Hopeville	77.3	90.5	64.2	102	26	55	7, 15	47	1.00	S	8	22	1	4	..	3
Hopkinton	70.7	.....	.....	100	26	52	5, 7	48	0.06	W	26	5	0	1	..	2
Humboldt	.....	.....	.....	.....	.....	.....	.....	.....	2.01	S	25	6	0	5	1	..
Independence	74.6	91.0	58.2	105	26	47	7	58	T	SE	28	3	0	0	..	..
Indianola	77.4	93 3	61.5	105	26	51	7	54	0.40	SW	24	0	7	2	..	1
Iowa City	73.6	89.5	57.8	100	26	48	7	52	0.90	NW	..	.....	.....	3	..	..
Iowa Falls	76.9	95.4	58.5	105	26	47	21	58	0.09	.....	.....	.....	.....	2	..	..
Jefferson	78.2	95.3	60.7	108	27	47	7	61	0.18	SW	21	10	0	2	..	..
Keokuk	78.0	90.0	66.0	102	26	56	22	46	0.37	SW	21	9	1	2	1	5
Keosauqua	77.7	92.2	63.2	104	26	50	22	54	0 77	.....	..	...	...	2	..	..
Knoxville	77.6	90.4	64.8	104	26	55	5	49	T	NW	23	6	2	0	..	..
Larrabee	76.2	92.5	60.0	106	26	46	7	60	0.69	SW	18	11	2	4	..	..
Le Claire	.....	.....	.....	.....	.....	.....	.....	.....	0.43	.....	.....	.....	.....	.....	.....	.....
Mason City	74.7	90.8	58.7	103	26	48	14	55	0.24	.....	.....	.....	.....	4	..	..
Maxon	79.9	.....	.....	.....	.....	.....	.....	.....	1.06	.....	21	10	0	2	..	..
Mechanicsville	74.6	89.5	59.6	102	26	49	7	53	1.07	SW	23	6	2	4	..	1
Monticello	75.4	89.4	59.7	103	26	46	7, 22	57	0.13	NW	27	4	0	2	..	..
Mt. Pleasant	75.1	.....	.....	96	.....	55	.....	41	0.26	.....	29	1	1	3	..	..
Newton	78.4	92.6	63.6	106	26	51	7	55	T	S	22	8	1	0	..	..
North McGregor	.....	.....	.....	.....	.....	.....	.....	.....	0.07	.....	.....	.....	.....	.....	.....	.....
Ogden	81.8	94.2	69.3	108	26	52	5	56	0.01	SE	.....	.....	.....	.....	.....	.....
Omaha (Neb.)	77.0	88.4	66.4	106	26	59	15	47	0.61	SE	19	9	3	5	..	..
Osage	73.0	.....	.....	103	26	57	7	46	0.49	S	20	11	0	2	..	2
Osceola	78.1	91.1	65.2	102	26	57	28	45	0.65	SW	8	20	3	5	..	6
Oskaloosa	75.0	89.6	60.3	103	26	48	7	55	0.06	SW	28	2	1	1	..	..
Ottumwa	77.2	90.7	63.6	103	26	53	7	50	0.11	SW	26	2	3	2	..	2
Ovid	78.5	95.8	61.7	107	24	50	7	57	0.48	SW	20	8	3	5	..	3
Panama	76.4	90.6	62.1	105	26	48	7	57	1.51	SW	26	4	1	4	..	..
Richland	77.6	..	...	105	26	64	6	41	1 78	.....	.....	.....	.....	1	..	..
Rockwell City	.....	.....	.....	.....	.....	.....	.....	.....	0.11	.....	28	3	0	2	..	4
Rock Rapids	77.2	94.8	59.6	106	26	42	24	64	1.88	S	19	12	0	4	1	4
Sac City	77.0	89.0	65.0	106	26	58	8, 20	48	2.76	.....	18	13	0	4	..	3
Seymour	78.4	93.0	63.5	103	24, 26	53	4	50	0.45	SW	29	0	2	2	..	..
Sibley	72.6	89.1	56.1	102	26	43	7	59	1.01	S	16	14	1	3	..	..
Sioux City	76.0	89.0	63.1	107	26	48	7	59	1.81	S	16	13	2	5	..	..
Spirit Lake	78.5	94.6	62.4	109	26, 27	43	7	66	0.07	SE	27	4	0	1	..	1
Sutherland	74.9	91.4	58.5	106	26	45	7	61	0.29	SW	7	23	1	5	..	2
Toledo	75.4	91.6	59.1	106	26	45	7	61	0.05	NW	27	0	4	1	..	..
Vinton	76.3	.....	.....	.....	.....	.....	.....	.....	0.30	SW	31	0	0	1	..	1
Washington	76.9	92.5	61.3	104	26	48	22	56	1.14	SW	.....	.....	.....	2	..	..
Webster City	77.7	.....	..	108	26	51	9	57	T	SW	25	5	1	0	..	4
West Bend	75.7	....	.....	105	26	50	5	55	0.65	S	18	12	1	3	..	..
Williams	75.0	.....	.....	107	26	41	11	66	0.14	S	28	3	0	3	..	..
Winterset	78.2	92.6	63.6	105	26	51	15	54	0.50	S	18	10	3	3	..	..
Means	76.4	91.5	61.3	104.1	..	50.0	.....	54.1	0.63	SW	21.9	7.8	1.4	2.6	..	..

DAILY AND MONTHLY MEAN TEMPERATURE FOR JULY, 1894.

STATIONS.	DATE.																													Monthly Mean.
	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	31st.	
Afton	82	75	75	68	72	74	74	73	74	77	80	82	74	73	73	80	80	82	81	77	74	82	78	80	81	88	84	82	82	82	76	78.0
Albia	82	78	76	72	69	70	66	74	76	77	80	82	80	74	75	80	81	83	82	80	70	70	76	84	80	82	86	82	82	82	82	77.8
Algona	72	77	71	70	70	66	69	73	77	80	83	77	68	77	76	80	81	83	74	72	72	73	78	73	82	90	88	76	78	82	82	76.5
Alta	76	74	72	68	69	68	68	73	76	76	81	81	72	73	74	78	79	82	78	72	73	77	81	80	81	89	88	78	78	84	80	76.7
Amana	82	74	70	69	67	70	66	69	72	75	81	87	74	70	75	78	78	80	80	76	68	67	74	82	74	84	86	90	78	80	79	75.8
Atlantic	77	72	66	68	68	71	66	68	72	70	78	80	64	64	68	74	76	82	78	74	69	74	77	76	72	89	85	80	78	80	77	74.1
Audubon	75	75	74	68	69	72	65	70	72	74	80	82	71	72	74	74	74	76	82	70	77	74	76	80	80	90	86	82	78	80	77	75.8
Belle Plaine	80	73	70	68	67	70	66	70	71	76	80	82	73	71	74	78	80	82	82	75	70	72	77	84	76	86	85	81	78	82	82	76.2
Bonaparte	87	76	75	75	72	73	70	70	74	78	80	82	80	74	79	78	81	82	82	78	71	70	76	84	78	86	84	86	82	80	78	78.2
Carroll	80	74	71	73	65	68	66	74	76	76	70	78	66	71	73	75	76	83	80	71	68	77	77	76	76	89	87	76	78	84	74	75.2
Cedar Falls	80	76	70	66	72	...	...	72	76	...	...	...	...	...	70	74	79	82	78	78	72	74	79	78	77	80	86	84	75	79	83	76.7
Cedar Rapids	81	74	72	69	68	66	65	69	71	76	81	84	74	77	78	77	78	80	81	76	70	69	72	82	85	85	88	85	88	80	75	76.1
Centerville	65	78	80	82	82	85	80	81	77	78	82	86	86	82	80	81	84	86	86	74	84	86	88	92	88	86	90	84	83	83	78	82.7
Charles City	76	64	74	63	64	64	63	67	70	74	75	80	67	67	73	74	77	78	79	74	70	70	78	76	75	85	86	78	71	75	79	73.2
Clarinda	80	75	72	70	70	73	70	72	74	74	78	81	73	88	70	73	77	78	80	77	73	75	78	80	79	88	86	80	80	80	80	76.3
Clinton	82	75	70	70	69	73	66	70	72	76	78	82	76	73	76	78	80	80	80	76	70	68	71	81	74	80	84	77	75	78	78	75.4
College Springs	78	76	73	70	70	72	69	74	74	72	78	84	77	69	71	76	81	80	80	76	72	77	80	80	80	90	84	82	79	80	82	76.9
Corning	78	73	72	69	68	72	66	70	72	72	78	82	72	68	68	73	74	78	78	76	70	74	77	79	75	88	85	82	77	79	76	74.7
Cresco	74	70	70	64	65	66	62	62	71	75	85	80	66	71	75	78	78	80	82	74	70	70	70	78	73	88	85	80	74	88	80	74.2
Davenport	82	74	72	70	71	71	69	72	76	78	80	82	76	74	78	81	84	83	81	74	68	70	76	84	76	82	85	78	78	80	78	77.0
Decorah	77	70	68	66	66	76	62	66	72	72	71	82	72	70	72	74	76	78	78	75	68	68	78	78	72	88	85	79	76	74	74	73.9
Delaware	76	72	72	67	69	65	68	70	73	74	81	83	71	74	75	79	80	80	80	72	68	66	74	78	74	83	85	82	76	80	78	75.0
Des Moines	85	77	72	72	70	74	68	73	75	78	78	84	76	70	73	77	79	82	81	78	72	75	80	80	90	85	83	80	81	80	77.7
Dubuque	82	75	74	70	70	69	66	72	76	77	82	84	80	74	78	80	82	82	84	74	68	68	78	80	74	84	87	82	77	82	80	77.1
Elkader	80	70	71	67	66	68	64	68	72	74	79	84	70	69	74	77	78	79	80	77	68	67	74	78	72	86	88	82	74	77	78	74.5
Emmetsburg	75	70	70	67	66	64	65	71	72	79	77	76	68	77	76	76	79	82	78	72	72	74	79	75	78	88	90	75	80	82	78	75.1
Fairfield	84	72	74	74	68	72	66	69	73	74	76	80	83	71	75	76	80	82	82	78	69	68	74	83	79	85	85	84	78	78	80	76.6
Forest City	80	70	75	72	64	69	62	66	69	74	77	81	73	66	72	74	77	79	80	75	68	74	80	72	82	73	88	82	70	78	82	74.3
Ft. Madison	87	79	77	74	74	78	72	74	77	74	81	86	82	82	80	82	86	83	84	76	75	75	81	84	82	92	89	80	78	79	79	80.9
Galva	72	72	72	...	67	67	...	68	74	76	82	81	68	65	68	74	76	76	70	65	69	72	80	76	76	90	88	80	...	...	...	74.0
Glenwood	81	83	74	70	79	74	71	74	84	76	82	84	74	66	73	84	87	84	83	76	74	78	87	83	81	91	89	83	82	85	85	80.0
Grand Meadow	76	68	69	65	67	65	67	70	72	77	80	78	66	72	76	78	80	80	79	70	66	72	66	76	76	86	86	76	78	78	74	74.3
Greenfield	80	74	74	78	70	73	67	74	76	80	80	82	74	77	72	78	81	84	81	76	73	74	86	82	79	89	85	82	80	82	77	77.5
Grundy Center	72	74	64	64	70	62	65	70	76	79	80	78	66	73	78	80	80	82	80	68	69	73	81	74	80	89	86	74	79	80	77	74.9
Hampton	78	72	71	66	68	67	65	70	74	78	80	80	67	74	76	80	81	82	82	72	69	72	78	78	76	88	85	79	74	82	70	75.7
Hopeville	84	77	76	72	70	73	70	73	74	78	80	82	75	72	71	76	73	81	81	75	72	76	72	82	81	89	83	82	76	80	77	77.3
Hopkinton	78	75	71	66	64	68	66	71	73	75	80	82	72	74	77	78	79	81	79	73	69	68	72	82	74	84	85	83	78	79	78	75.0
Independence	78	70	71	66	68	68	64	68	70	74	80	82	73	70	74	76	77	80	80	76	70	69	74	80	76	85	86	82	74	76	76	74.6
Indianola	82	73	72	70	70	72	69	76	75	77	82	85	82	72	75	74	74	81	80	78	72	76	78	83	80	90	86	...	81	82	78	77.4
Iowa City	80	72	70	68	65	68	64	67	70	72	76	82	70	70	74	76	77	80	76	75	68	65	70	78	72	80	81	80	76	75	78	73.6
Iowa Falls	...	...	...	...	...	...	...	...	74	75	78	...	...	72	75	81	78	78	80	78	70	71	82	78	76	86	82	76	72	74	78	76.9
Jefferson	76	74	76	70	71	73	66	70	71	77	81	83	80	73	73	80	80	82	81	80	71	75	81	82	78	90	92	88	81	84	85	78.2
Keokuk	88	78	78	77	70	74	70	73	75	78	80	82	80	73	78	82	82	82	80	74	70	70	76	85	78	86	83	82	78	80	80	78.0
Keosauqua	86	76	75	74	68	71	73	70	74	78	78	84	80	72	78	78	78	81	82	77	70	69	75	86	76	87	85	84	82	81	78	77.7
Knoxville	81	76	72	70	70	73	68	75	74	78	80	82	80	78	74	76	78	82	82	78	72	72	77	84	80	89	84	84	80	80	78	77.6
Larrabee	74	72	72	66	68	66	67	78	76	78	82	81	72	72	74	76	77	81	75	70	72	78	81	82	78	89	88	79	77	84	79	76.2
Mason City	74	76	70	...	...	...	...	68	74	80	78	68	77	70	74	76	78	80	80	72	64	70	77	76	74	86	84	78	71	82	80	74.6
Maxon	86	74	78	70	70	73	71	82	79	80	80	88	74	76	78	81	81	88	83	74	72	83	78	90	88	92	87	84	82	86	75	79.9
Mechanicsville	80	72	69	68	68	68	65	70	72	77	80	78	72	72	75	79	80	81	79	73	68	67	72	81	74	82	82	80	78	77	76	74.5
Monticello	78	72	70	66	71	66	68	72	74	76	80	83	71	74	77	76	80	82	82	73	66	68	75	81	77	84	84	79	77	79	77	75.4
Mt. Pleasant	82	74	76	74	73	71	68	72	74	78	80	84	75	75	76	74	76	80	78	73	62	62	68	78	74	82	84	78	76	76	75	75.1
Newton	85	77	73	71	72	72	69	72	75	79	82	84	74	72	75	79	80	82	81	88	74	72	80	84	78	90	84	80	80	80	82	78.1
Ogden	82	74	70	68	72	76	73	80	82	84	86	85	78	78	79	85	84	87	92	87	82	82	89	83	87	....	92	88	80	84	84	81.8
Omaha (Neb.)	76	76	71	70	73	74	72	74	76	77	80	82	71	68	72	76	78	82	80	74	74	76	82	82	82	92	80	81	80	82	79	77.0
Osage	72	70	72	63	63	64	64	69	73	76	80	76	68	72	72	77	77	78	72	71	69	73	76	78	85	83	77	70	75	75	75	73.0
Osceola	84	79	76	70	...	74	...	74	76	78	79	83	76	74	74	80	79	81	82	75	74	74	80	...	...	89	...	84	80	81	74	78.1
Oskaloosa	78	74	70	68	67	70	66	68	72	76	80	82	74	68	72	74	76	78	78	74	70	70	75	84	75	88	84	82	79	80	74	75.0
Ottumwa	84	77	76	71	70	72	68	70	74	79	80	84	78	71	76	78	78	80	80	77	70	68	76	86	78	87	84	85	80	80	76	77.2
Ovid	90	78	80	74	72	76	70	75	75	78	80	82	78	75	73	74	80	80	81	80	74	74	78	81	78	90	84	86	80	81	78	78.8
Panama	82	75	72	68	70	70	68	77	75	75	80	79	72	69	72	74	78	82	78	72	72	76	80	79	76	90	86	80	81	83	76	76.4
Richland	82	74	74	70	71	69	72	71	78	79	80	85	72	73	78	79	82	83	82	72	69	74	79	83	80	82	83	78	80	83	79	77.6
Rock Rapids	80	72	75	69	70	66	68	71	76	81	82	75	71	74	79	77	79	80	82	81	80	80	88	78	80	84	84	84	84	79	74	78.2
Sac City	77	75	68	68	74	68	71	71	74	78	78	79	79	80	80	76	77	81	78	69	70	76	78	78	80	87	89	84	83	82	81	77.9
Seymour	88	75	77	74	78	74	69	75	76	78	78	82	78	76	74	80	82	82	74	77	72	72	81	84	79	88	84	84	80	80	77	78.4
Sibley	72	73	72	64	66	66	62	69	70	76	78	78	66	67	70	72	74	78	75	66	68	74	76	70	74	81	87	77	74	74	80	72.6
Sioux City	77	72	72	68	68	69	66	74	76	80	82	82	72	71	74	75	78	82	73	71	71	78	80	81	78	90	88	78	74	84	75	76.0
Spirit Lake	78	74	78	73	70	67	67	76	76	82	86	80	74	76	78	80	82	84	78	72	71	80	84	80	82	88	90	78	84	88	82	78.5
Sutherland	73	72	71	66	69	66	66	73	73	76	81	80	71	74	78	75	75	80	74	70	71	77	79	77	74	86	87	78	74	83	79	74.9
Toledo	81	74	69	66	66	66	64	67	70	71	80	84	76	70	78	78	78	80	80	76	69	69	70	84	76	89	85	84	76	80	80	75.4
Vinton	77	74	68	68	70	68	68	71	74	77	81	82	69	73	78	82	82	82	77	72	69	70	81	82	78	88	84	80	78	84	78	76.3
Washington	86	74	74	71	69	72	67	70	74	78	79	83	78	72	76	79	80	82	80	76	70	68	75	85	77	84	85	84	79	80	80	76.0
Webster City	80	68	66	70	70	66	67	72	74	80	79	70	76	80	82	84	83	82	76	70	72	77	83	80	81	92	88	84	84	84	78	77.3
West Bend	76	75	70	...	64	68	71	76	78	81	74	87	74	77	77	80	80	82	79	70	72	76	80	79	79	91	86	85	77	81	79	75.6
Williams	78	78	80	80	80	79	70	74	79	80	78	84	78	78	78	81	82	82	82	78	74	78	81	82	78	86	84	82	78	82	79	79.6

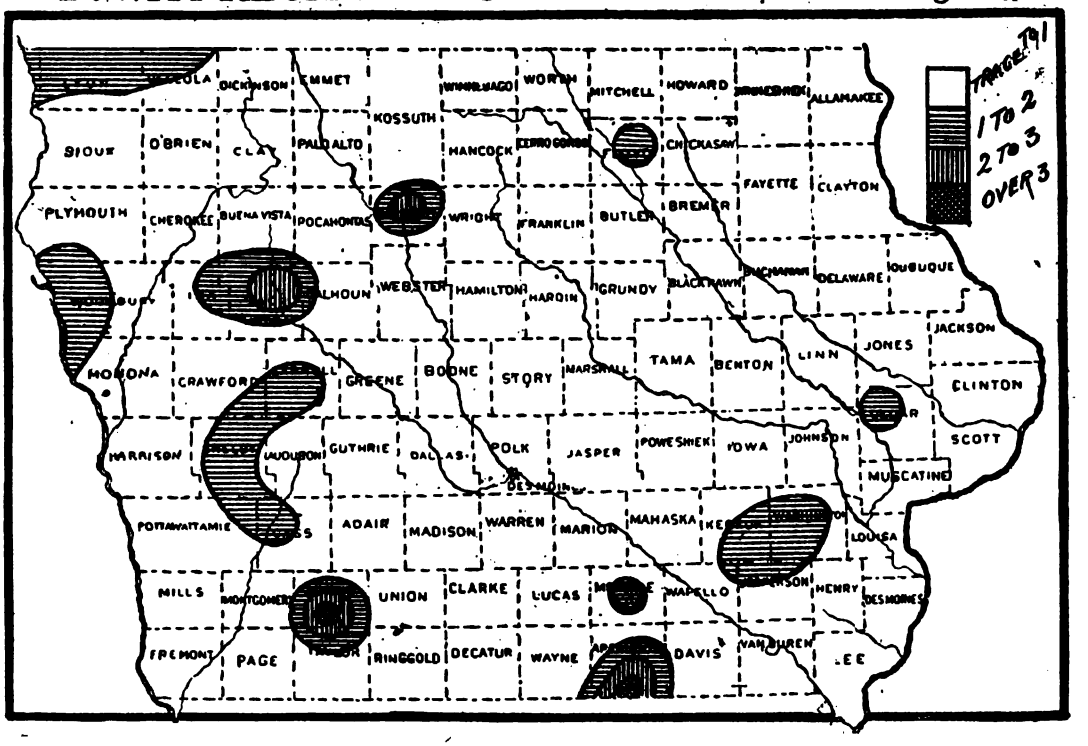
MAXIMUM AND MINIMUM TEMPERATURE FOR JULY, 1894.

| STATIONS. | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | | 9 | | 10 | | 11 | | 12 | | 13 | | 14 | | 15 | | 16 | | 17 | | 18 | | 19 | | 20 | | 21 | | 22 | | 23 | | 24 | | 25 | | 26 | | 27 | | 28 | | 29 | | 30 | | 31 | | Mon'y Mean. | |
|---|---|---

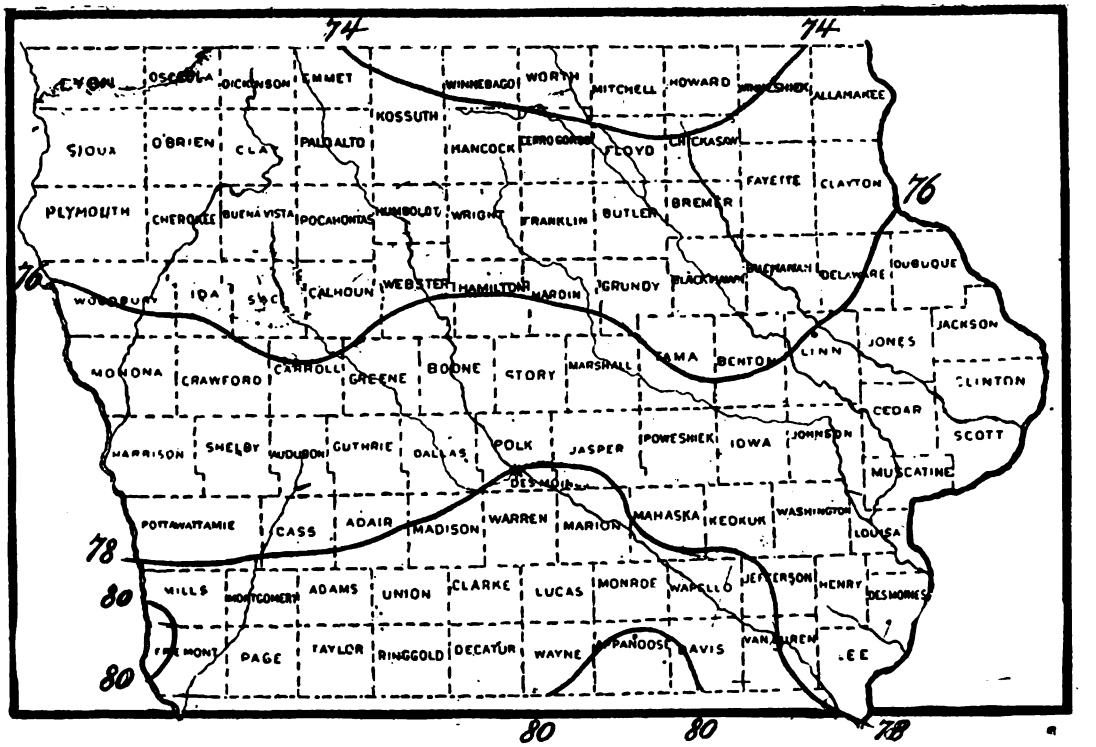
DAILY AND MONTHLY PRECIPITATION FOR JULY, 1894.

STATIONS.	DATE.																																Total.
	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th	27th.	28th.	29th.	30th.	31st.	
Afton			0.03																T			T					0.04			0.89	0.96
Albia			0.01																0.50								T			0.22	0.73
Algona					0.01														0.23												0.25
Alta			0.08		0.02								0.02						0.05				T							0.22	0.39
Amana																				0.80							T			0.15	0.98
Ames (W. H. Helleman)																			T				T			0.02			0.02		0.04
Ames																			T				T			0.02			0.02		0.04
Atlantic			0.24																0.08								T			0.91	1.23
Audubon				T															0.44											0.42	0.86
Belle Plaine																					0.08								T			0.08
Bonaparte			T															T		0.08								0.04		0.07	0.19
Carroll																													T		1.73	1.73
Cedar Falls				0.02																0.16									T		T	0.18
Cedar Rapids		1.00																	1.25								0 15	T		1.10	3.50
Centerville			T											T					0.98								0.03			0.18	1.19
Charles City			0.30											T					0.02	0.02							0.07				0.41
Clarinda																				0.21							0.18				0.39
Clinton			0.24											0 06													0 08			0.06	0.44
College Springs																			0.30											2.50	3.30
Corning	0.28		0.22																0.06								0.02			T	0.09
Cresco					0.01		T												T	0.44							T				0.44
Davenport			T			T													0.31							0.11	0.11			0.01	0.48
Decorah											0.05								0 07								0 04				0.11
Delaware																			0 15	0.09			T	T			T	T			0 20
Des Moines	T		0.01										T							0.02											0.02
Dubuque																			T								0.10				0.16
Elkader														0.06																	
Emmetsburg			0 02		T														0.04				0.01	T						0.40	0.47
Fairfield			T																	T									0.04	0.03	0.07
Forest City					0.26														0 07								0.07				0.50
Fort Madison			T																	T			0.10	0.05			0.17	0.16			0.38
Galva																			0.92					0.05					0.15		1.12
Glenwood	0.06				0.31																										0 37
Grand Meadow																															0.45
Greenfield	T		0.20					T					T										T			0.05	T			0.32	0.57
Grinnell																															
Grundy Center			0.05																0 04												0.09
Hampton			0.08		T														0 62				T				T				0.70
Hopeville			0.12					T											T	0.04			0.10				T	T		0.74	1.00
Hopkinton			T																	0.05							T				0.05
Humboldt			0.07		T														1.77				0.04	0.02					0.11		2.01
Independence			T																T	T							T		T		Trace
Indianola			T	T																0.05			T					T		0.35	0.40
Iowa City			T																	0.70							0.07			0.13	0.90
Iowa Falls			0.06																T											0.03	0.09
Jefferson																				0.08				T			0 10				0.18
Keokuk			T	T																T				T			0.25	0.12		T	0.37
Keosauqua			T	T															T	0.12							T	T		0.65	0.77
Knoxville			T																T	T							T			T	Trace
Larrabee			0.07		0.06														0.18											0.38	0.69
Le Claire																				0.07							0.36				0.43
Mechanicsville						0.03														1.00							0.02			0.02	1.07
Monticello			0.02																	0.11											0.13
Mt. Pleasant																				0.05							0.15	0.06			0.26
Newton																			T								T	T			Trace
North McGregor																				T							0.07				0.07
Ogden																			T							0 01					0.01
Omaha, Neb	0.16		0.35			0.01														T									0.06	0.04	0.61
Osceola			0.13																	0.06			0.06				0.07			0.33	0.65
Oskaloosa			T																					T			T	T		0.05	0.05
Ottumwa			0 01	T															T								T	T		0.10	0.11
Ovid			0.09																0.18									T		0.21	0.48
Panama			0 08																0.02										0.04	1.17	1.31
Richland			T																1.78								T	T			1.78
Rockwell City			T										T						0.03											0.08	0.11
Rock Rapids					0.23					T		T							0.25				0.15						1.25		1.88
Sac City			0.25										0.01						2.25											0.25	2.76
Seymour			0.20																											0.25	6.45
Sibley					0.27					T									0.61			T	0.13	T							1.01
Sioux City	T		0.07							T			0.04						1.13	0.01				T						0.56	1.81
Spirit Lake																			0.07										T		0.07
Sutherland			0.02		0.03														0.06				0.02							0.16	0.29
Toledo																				0.05											0.05
Vinton																				0.30											0.30
Washington																															
Webster City		T																									0.70			0.44	1.14

IOWA PRECIPITATION CHART JULY 1894



MEAN TEMPERATURE JULY 1894



METEOROLOGICAL STATIONS AND OBSERVERS.

From the following, weekly and monthly reports of Meteorological data are received by the Iowa Weather and Crop Service.

Afton	Hon. N. W. Rowell.
Albia	Cal Koontz.
Albia (Maxon)	Gus Johnson.
Algona	C. D. Pettibone.
Alta	D. E. Hadden.
Amana	Conrad Schadt.
Ames (Exp. Station)	W. H. Heileman.
Ames	Fred L. Kent.
Atlantic	J. W. Love.
Atlantic	Geo. W. Franklin.
Audubon	J. F. Hocker.
Belle Plaine	H. W. Vandike.
Blakeville	James Rodgers.
Bonaparte	Hon. B. R. Vale.
Carroll	Moses Simon.
Cedar Falls	Prof. A. C. Page.
Cedar Rapids	H. D. Olds.
Centerville	Prof. H. E. Reister.
Charles City	J. W. Smith.
Clarinda	A. S. Van Sandt.
Clinton	Luke Roberts.
College Springs	A. A. Berry.
Corning	John W. Bixby.
Cresco	Gregory Marshall.
Council Bluffs	E. W. Hart.
Davenport	*F. J. Walz.
Delaware	Wm. Ball.
Decorah	F. H. Baker.
Denison	M. E. Lies.
Des Moines	*Geo. M. Chappel, M. D.
Dubuque	T. W. Ruete.
Eagle Grove	C. A. Schaffter.
Eldora	Prof. C. F. Woodward.
Elkader	Chas. Reinecke.
Emmetsburg	J. A. Carmichael.
Fairfield	Charles J. Fulton.
Fayette	R. Z. Latimer.
Ft. Madison	Miss L. A. McCready.
Forest City	J. A. Peters.
Galva	W. A. Crowley.
Glenwood	Seth Dean.
Greenfield	J. G. Oulver.
Grinnell	Prof. S. J. Buck.
Grundy Center	Chas. G. Rogers.
Hampton	E. O. Grenelle.
Hawkeye	J. W. Bopp.
Hopeville	M. T. Ashley.
Hopkinton	Theo. Marks
Humboldt	H. S. Wells.
Independence	E. F. Wulfke.
Indianola	Prof. J. L. Tilton.
Iowa City	Prof. A. L. Arner.
Iowa Falls	J. B. Parmelee.
Jefferson	Dr. Chas. Enfield.
Keokuk	*Fred. Z. Gosewisch.
Keosauqua	Prof. J. H. Landes.
Knoxville	Casey and Reeves.
Larrabee	H. B. Strever.
Logan	Mrs. M. B. Stern.
Mason City	H. I. Smith.
Marshalltown	C. M. Cook.
Maquoketa	Dr. A. B. Bowen.
Mechanicsville	Rev. J. W. Hubbard.
Mooar	F. G. Thomas
Monticello	Henry D. Smith
Mount Vernon	Prof. A. Collin.
Mt. Ayr	Hon. Wm. Shriver.
Mt. Pleasant	Dr. Max E. Witte.
Muscatine	J. P. Walton.
Newton	A. Lufkin.
Ogden	E. Sayre.
Omaha, Neb	*Geo. E. Hunt.
Osceola	A. W. Lewis.
Ovid	H. C. Miller.
Osage	G. D. Pattingill.
Oskaloosa	Jos. Boyd.
Ottumwa	L. J. Baker
Panama	Wm. J. Wicks.
Postville	F. L. Williams.
Richland	Wm. A. Shaffer.
Rock Rapids	W. C. Wyckoff.
Rockwell City	G. B. Rigg.
Seymour	Mrs. C. A. Conger.
Sibley	H. G. Doolittle.
Sidney	G. V. Swearingen.
Sioux City	*U. G. Pursell.
Sac City	Dr. C. Brown.
Spirit Lake	W. C. Drummond.
Sutherland	W. H. Bloom.
Tipton	J. M. Rider
Toledo	Chas. Mason.
Vinton	T. F. McCune.
Villisca	Paul Welch.
Washington	Wm. A. Cook.
Webster City	C. M. Trumbauer.
Winterset	Will McKnight.
West Bend	Phil. Dorweiler.
Williams	M. L. Fuller.

*U. S. Weather Bureau.

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Agency	J. H. Van Zant.
Albia	Wm. Mercer.
Alta	Hon. H. T. Saberson.
Ames	Henry C. Wallace.
Anita	H. T. Chapin.
Ankeny	Ed. Parmenter.
Battle Creek	A. Preston.
Bloomfield	Geo. Duffield.
Boone	L. C. Morris.
Bristow	G. W. Wells.
Carson	G. N. Ferguson.
Centerville	Henry Galley.
Charles City	W. B. Towner.
Charlton	C. C. Burr.
Clarksville	F. M. Russell.
Corning	Jerome Smith.
Clermont	Chas. Larrabee.
Concord	J. M. Elder.
Council Bluffs	L. Prouty.
Dedham	J. A. Horton.
Danville	Sherman Matthews.
Emerson	D. B. Nims.
Ely	Hon. A. J. Fuhrmeister.
Fulton	Carl S. Frank.
Fontanelle	Hon. L. M. Kilburn.
Ford	J. C. Richards.
Fort Dodge	R. W. Blaine.
Geneva	Wm. H. Thompson.
Gosport	B. F. Banta.
Grand River	Dr. John Daykin.
Grinnell	A. O. Price.
Guthrie Center	W. W. Bailey.
Hesper	G. E. Dillingham.
Hodge	James Piper.
Hamlin	F. P. Moore.
Humeston	Hon. S. H. Moore.
Independence	C. L. Thomas.
Indianola	T. B. Hammer.
Larrabee	H. H. Carnahan.
LeMars	Hon. Henry Schrooten.
Ledyard	Frank Miller.
Lawler	Hon. Wm. Glattly.
Lockridge	John F. Farman.
Manning	H. W. Pollock.
Mapleton	A. Lamb.
Marshalltown	Hon. J. G. Brown.
Mason City	Wm. Nettleton.
Mt. Pleasant	W. S. Wright.
Milton	Hon. E. C. Holland.
Mount Vernon	Robert Smith.
Newton	J. P. Beatty
North English	J. L. Williams.
Nevada	O. G. Ashford.
Osage	E. W. Stacy.
Orange City	H. J. VandeWaa.
Paton	A. B. Condit.
Pittsburg	G. C. Duffield.
Polo Station	A. E. Miller.
Prescott	G. W. Iden
Paullina	Stephen Harris.
Rockwell City	J. G. Palmer.
Rock Rapids	D. E. F. Merrill.
Rossville	F. B. Wiley
Sandusky	Z. Hollingsworth
Sageville	Hon. F. N. Knoll.
Seymour	J. F. Wagner.
Shenandoah	Reuben Mullison.
Spirit Lake	C. E. Abbott.
State Center	E. N. Thompson.
Sumner	John Dawson.
Tama	W. G. Malin.
Unity	Edw. Hummer.
Van Horn	Spencer Smith.
Wapello	O. P. Smith.
Waukee	John Wragg
Wheatland	D. Beckman.
Willow Creek	W. S. Nicholson.
Winterset	H. A. Klusman.
Wall Lake	F. E. Wilcox.
Walnut	F. L. Martin.
What Cheer	O. D. Lawrence.

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UNITED STATES DEPARTMENT OF AGRICULTURE
WEATHER BUREAU.

MONTHLY REVIEW

OF THE

Iowa Weather and Crop Service.

VOL. V. —AUGUST, 1894.—NO. 8.

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CENTRAL STATION, DES MOINES, IOWA.

J. R. SAGE,
DIRECTOR.

GEO. M. CHAPPEL, M. D.,
LOCAL FORECAST OFFICIAL,
U. S. WEATHER BUREAU, ASS'T DIRECTOR.

DES MOINES:
G. H. RAGSDALE, STATE PRINTER.
1894.

THE IOWA WEATHER AND CROP SERVICE

Was established by act of the Twenty-Third General Assembly, and placed under supervision of the Board of Directors of the State Agricultural Society, constituted as follows:

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U. S. Department of Agriculture---Weather Bureau.

MONTHLY REVIEW

OF THE

IOWA WEATHER AND CROP SERVICE.

VOL. V.] AUGUST, 1894. [No. 8.

SEPTEMBER CROP REPORT.

Following is a summary of the September reports of the crop correspondents of this Bureau:

The average condition of corn is rated 36 per cent. This indicates an average yield of 11.88 bushels per acre. The present acreage is 6,738,000 acres, and if this estimate is borne out by the final returns, the aggregate for the State will be about eighty million bushels. In the southern and central districts a large portion of the crop has been cut, and the balance is mostly beyond danger from frost. In the northern districts cutting is rapidly progressing, but a portion of the crop is still immature, and would be materially damaged by a killing frost.

The amount of corn that will this year be put into the farmers cribs will be very light—probably less than forty million bushels. But under stress of necessity the larger part of the fodder will be utilized; and this added to the grain will give in feeding value a total corn yield of about 60 per cent of an average, if it is cut and cured in good condition.

Other crops are rated as follows: Flax, 65; potatoes, 35; pastures, 33; apples, 60; grapes, 55 per cent.

EDITORIAL NOTES.

One inch of rainfall makes a total of 22,623 gallons per acre, and 324,612,902 gallons on a square mile of land.

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The observers at Lick and Mt. Diablo charted over 300 meteors on the nights of August 10 and 11.

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The Russian thistle, it is said, will thrive in the worst kind of a drouth. There seems to be wonderful vitality in the noxious things of this world. The good of it is that it makes mankind rustle to get a living.

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During the month of August a scorching drouth prevailed in the province of Ontario, being especially severe in the western peninsula, and along the north shore of Lake Ontario half way to Montreal was nearly as serious. Destructive fires occurred in the extensive forests of that region, and the town of Hensal, Huron county, was nearly surrounded by the raging flames. It seems that the contiguity of great bodies of water and vast forests does not insure an invariable supply of rainfall.

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The present drouth may possibly result in a general boycott of the men who are making drain tile. People are settling down to the conclusion that they cannot have rain if all water is drained off the surface and carried away to the sea.—*Daily Capital.*

If that is true it will furnish a new illustration of human folly. There never was a time when the economic value of tile drainage was more fully attested than during the past season. The amount of rainfall is in nowise affected by draining off the surface water, though such drainage may lower the water level in the earth and cause wells to go dry. Tile drainage is no more responsible for the drouth in Iowa than it is for the war in Asia.

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Capt. R. E. Kirkham, local forecast official of the Weather Bureau at New Orleans, has received official notice of the establishment of a meteorological station at Belize, British Honduras. The records of that station will be of value in tracing the course of cyclones, which originate in tropical waters and sometimes strike the Gulf coast with very slight warning of their approach.

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The *Osceola Sentinel* of August 16th gives account of a meteor that fell on the night of the 13th, making a brilliant light and striking the earth in the garden of Rev. Samuel Lockwood, of that place. It was found the next day, and is described as a pear-shaped stone, measuring 4½ inches the longer diameter, and 3½ the shorter, having the appearance of a composite with sandy particles imbedded in the dark substance.

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The man of the hour has made himself known. He has applied to the governor of Kansas for the position of climate regulator, and claims to be able to produce rain in thirty-five different ways and to prevent too severe a

winter or too hot a summer. For $100 a month and traveling expenses he would agree to give the State of Kansas a climate perfect in every respect, and would like to have a year's engagement. In further explanation he says: "It is rather late in the year for a beginning, as climate must be cultivated the same as everything else when we wish to produce superior results, but if another seeding is planted I can prevent its freezing this winter, with plenty of pure rain. I think the United States government should pay for such service. If I could receive the appointment of weather adjuster for the United States at a salary of $3,000 a year, it would be a great benefit. If you cannot give me a position please help me along with a few dollars, as I am soliciting contributions for that purpose."—*Sioux City Journal.*

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The wheat crop of Europe is unusually abundant, and of good quality. Americans will do well in this year of corn shortage to feed some of their surplus wheat to growing stock.

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The summer in England has been unseasonably wet and cool. They describe it as "a year without a summer." But reports indicate that the wheat crop of England, and of Europe generally, will be large.

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The newspapers have been filled with the awful details of the forest fires that raged through Kanabec and Pine counties, Minnesota, during the last week in August resulting in the loss of hundreds of lives. It was the most terrible calamity of the kind recorded in the history of this country. As one of the results of the drouth the dense forests of that section became dry as tinder; and it should be noted that the vast stretches of forests and the great numbers of lakes and swamps of that region did not save it from the effects of the widespread drouth.

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This is one of the best possible years for the selection of seed corn. The plant which, in such an arid season, has maintained a sufficient measure of vitality to produce ears of full length, well-filled with plump kernels, possesses the requisite qualities for high breeding. A series of such years would possibly develop a species of maize of sufficient hardiness to thrive with even a modicum of moisture.

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Prof. W. A. Henry, of the Wisconsin Experiment Station says:

"As to the relative merits of corn and wheat it is hard to draw any exact comparison, for we can only compare things that are alike. For growing animals I place wheat from 10 to 25 per cent above corn; for simply fattening growing hogs I doubt if it would go any further pound for pound. A mixture of wheat and corn, ground, will make more pork than either alone I am quite sure."

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Answering an inquiry in relation to the fertilization of corn Prof. Pammel, of the Agricultural College, says: "Every kernel of corn requires only a single pollen grain, and to each kernel of corn there is attached one long silk thread, which will vary from a few inches to over a foot in length. That every kernel of corn has a silk thread may easily be demonstrated by anyone who will take the pains to carefully remove the husks and follow the silks. There are as many silks as kernels of corn, and every seed that sets results from the impregnation of the pollen tube which passes down the thread and fertilizes a little cell contained in the undeveloped kernel of corn. The number of pollen grains attached to the silk thread varies. It may have a few or a great many, but only one pollen tube is needed to fertilize the young kernel."

"The number of pollen grains produced by corn is enormous. Nature is wasteful, it might seem, but this enormous number must be produced in order to practically secure fertilization."

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Prof. Budd says: "In no part of the earth has the benefit of extended timber planting on interior prairies been so perfectly demonstrated as in Russia."

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Some people are heard to say that farmers realize about as much money for a half crop as for a full crop of corn, the market-price being so much higher in years of shortage. That is a mistaken view of the matter, being based upon the assumption that our corn is mainly a commercial crop. The truth is, even in years of greatest abundance not more than about 12 per cent of the corn produced in Iowa is shipped out of the State. The vast bulk of it, year by year, is not transported across a county line; but it is mostly used as raw material in the manufacture of pork, beef, mutton, wool, dairy products and horse flesh. For this purpose 20 or 25 cent corn is worth as much as 50 cent corn; and the manufactured products this year are not higher on the average than they were in years of bountiful crops. The Iowa farmers, as a whole, will be buyers and not sellers of corn in the coming twelve months. They will require all they have raised and as much more, or its equivalent in other feed stuffs, to keep and fatten their own stock. "Hold your corn," is a good motto for Iowa farmers this year; not for higher prices, but for the wintering and fattening of their own herds. There is no profit in growing corn for the market in any year; much less in such a season of drouth as we have experienced in '94.

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The *New York Herald*, in a recent article on "Sun Spots and Drouth," refers to the belief among certain scientists that excessive solar heat and extensive drouths bear a close relation to the periods of maximum sun spots. The sun has displayed some gigantic spots during the past summer, but it would be quite difficult to prove that solar disturbances are responsible for our shortage of moisture. While this mid-continent region has suffered from deficiency, other portions of the country have had an excess. And in England 1894 is likely to be referred to as "a year without a summer," on account of the excessive cold and wet weather. On an average there has been no greater amount of solar heat expended than in other years, and the amount of rainfall has not been less than usual; the only trouble has been a great inequality in distribution.

During the summer season in Japan, says the *New York Journal*, drouths are very frequent, and the rice fields, before so beautiful, presenting as they do all the different shades of green imaginable, gradually lose their brilliancy of color, turn yellow and parched, and threaten the total destruction of the crop. Not only does the rice suffer, but the wells dry up and necessitate the carrying of water from long distances. So a drouth in Japan is, indeed, a great calamity.

After waiting and hoping in vain for a downfall of rain, the people turn enmasse to evoke the power of their deities to send them the saving showers. A procession is formed of perhaps two hundred men, all nearly naked, who, carrying straw emblems representing the sun with the rain pouring from it, and with long streamers having prayers written on them flying in the wind, proceed to the nearest river or bay, where the whole company wade into the water until they are waist-deep, and, surrounding the emblems, pray aloud and throw water on the images with both hands.

After doing this several times the procession is reformed, when it proceeds to the temple to pray again. This ceremony is repeated several times, and should the rain come in abundance prayers are offered in thanksgiving; should it be only a shower they blame themselves for not having prayed fervently enough, and continue their devotions until a downpour takes place.

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Mr. Wm. Battin, of Marshall county, writes to the *Register* as follows: "The more I examine the subject the more I believe that the rains and storms and winds are beyond man's control. Raising timber and damming streams may help to conserve former conditions. But we had drouths and floods before the country was improved. Some of us remember the floods of 1858 and the drouth of 1861. Iowa then had plenty of ponds, but they dried out. The parched air withered the corn. Then our main crop was wheat and it was a good crop. The ponds and sloughs and creeks and rivers did not keep away the drouth then, and I think they would not now if provided. When man can give direction to the wind, then he can direct the load the wind carries. While the sun by its heat is constantly raising up and loading the air with multiplied millions of tons of water it would seem as futile for man to undertake to give it direction as was the effort of the woman to sweep back the ocean tide with a broom.

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Mr. G. L. Tremain, of Humboldt, writes as follows: "In 1872 I saw the wheat crop of Mitchell county, Iowa, crinkled in one day's hot wind so that it was almost impossible to save it; machines would cut the straws twice, leaving the heads on the ground. And yet little damage resulted. In a residence of 44 years in Iowa I have never seen as dry or hot a summer as this, and still there are good crops."

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The corn fields furnish numerous object lessons this season. Farmers should study them well, and profit by their suggestions, for we shall have drouths in the years to come—probably not many so severe as this has been, but we must take the lean as well as the fat years.

RAIN-MAKING DOWN TO DATE. II.

ARE BATTLES FOLLOWED BY RAIN? ARTIFICIAL METHODS OF PRODUCING RAIN CONSIDERED.

J. R. Sage in Midland Monthly.

Drouths and floods have been scourges of mankind in all ages, and the resources of human ingenuity have been exhausted in efforts to remedy nature's occasional tendency to extremes in the distribution of moisture. So the question, "Can we make it rain?" and its converse, "Can we make it dry up?" antedate modern science and civilization.

From the beginning there have been professional rain-makers and rain-stoppers, and among barbarous people faith has been most implicit in their ability to control the elements, or to influence the deities which preside over earth, sea and sky. The ancient "medicine men" seldom failed, for they possessed the gift of continuance and persisted in the performance of their divinations, incantations or rain-dances, until the heavens were propitious.

In modern times the aid of governments and science has been invoked to correct nature's irregularities, and, curiously, similar methods have been employed both to break drouths and to avert destructive storms; an application possibly of the homeopathic principle, *similia similibus curantur*—that which makes it rain will cure excess. Din and racket, beating tom-toms, bell-ringing, concussions, explosions, and making big noises generally, have been the agencies used alternately to drive away storms and to break drouths. And if we may credit contemporaneous reports they have been equally effective for both purposes.

Mr. R. de C. Ward (*Am. Met. Jour.*, March, 1892), states that in the memoirs of Benvenuto Cellini there is mention of the fact that an impending rain-storm was averted in the year 1539, on the occasion of a procession in Rome, by firing artillery in the direction of the clouds, which had already begun to drop their moisture. M. Arago, the eminent French astronomer, states that as early as 1769 it was the practice in certain towns in France to fire guns to break up storms, but he expressed doubt as to the effectiveness of that method. There have been numerous learned dissertations published by the scientists of Europe, within the last two centuries, relative to the possibility of breaking the force of storms by the use of explosives, and the question seems to have been settled by a negative conclusion.

In this country in recent years the question has assumed the opposite form, and the popular belief in the efficacy of explosives as rain-producers has stimulated scientific inquiry and led to some costly experiments under government auspices. The basis of this theory is the statement, which large numbers of people accept as true, that great battles have been generally, if not invariably, closely followed by storms.

This belief is deeply rooted in the popular mind, somewhat like the various notions held by many people in relation to the effects of the moon's phases upon the weather. And it appears to be a traditional idea, for the

belief that battles cause rain was prevalent before the invention of gunpowder.

Plutarch says, "It is a matter of current observation that extraordinary rains generally fall after great battles;" and he accounts for it on the supposition that the vapors from blood steam forth and cause precipitation, or that the gods mercifully send rain to cleanse the earth from the stains of warfare. Without doubt there was as sound a basis for that theory in ancient as in modern days, and rains followed battles as closely before as since the invention of gunpowder.

A book entitled "War and the Weather," by Mr. Edward Powers, published in 1871, incited renewed discussion of this question, and was chiefly instrumental in bringing about the recent rain experiments. Mr. Powers presents apparently strong proofs to sustain his theory that explosions may produce rain. He refers to about two hundred battles of our Civil War which were followed by rain, and also to a number of campaigns and sieges during which it was unusually wet. The intervals between the battles and the storms they are supposed to have produced vary from a few hours to one or two days; but it rained, soon or late, after every one of the notable two hundred or more battles,—that fact is well established. Mr. Powers concedes that his facts do not absolutely sustain his hypothesis, but he contends that the relation of cause and effect is at least placed in the realm of probability.

It has been stated that there were over two thousand battles fought during the late war that are not included in Mr. Powers' list of rain-producing conflicts. If this is correct, it is not at all singular that in so great a number of battles, salutes, bombardments and similar occasions of cannonading there were noted two hundred instances where rain closely followed the firing. We might indeed marvel if the number were less.

The writer was in four of the battles included in the list of alleged storm-breeders, and has a vivid remembrance of all the scenes, incidents and experiences of those hard-fought conflicts. Having always been something of a "weather crank," the meteorological conditions of those days of excitement and exposure did not escape observation. And it may be stated, as a conclusion based on actual knowledge of the matter, that there was no visible evidence of any connection between those battles and any subsequent rain-storms.

The campaigns in Virginia and Maryland during August and September, 1862, were especially burdensome to the Union army because of the great heat and infrequency of refreshing showers, albeit there was an abundance of gunpowder burned. About the middle of September (10th to 18th) there were seven or eight days of almost continuous fighting, and cannonading at Harper's Ferry, Turner's Gap, Crampton's Gap and the Antietam, and yet in answer to the soldiers' fervent prayers for rain to temper the great heat there came but two light and insufficient showers during that campaign. In matter of fact during the second decade of September, 1862, that portion of Maryland did not receive its normal amount of rain. It was exceptionally drouthy for that section at that time of the year.

In that portion of Central Maryland and Northern Virginia where the Army of the Potomac marched and fought in August and September, 1862, the normal rainfall is about one inch a week, and the average frequency of showers is one in three to three and a half days. The boys in blue who marched and countermarched under Pope and McClellan through the heat and dust of that campaign, from Manassas to Antietam, had occasion to remark that there were protracted intervals between drinks and cooling showers. That, at least, is the very distinct remembrance of one of them, who about that time took his preparatory degree in the G. A. R.

The Fredericksburg and Chancellorsville campaigns do not furnish material support to Mr. Powers' theory, though they are classed among the rain-makers. At Fredericksburg the heavy firing began on December 11, 1862, and was kept up at intervals through the 12th and 13th. On the 14th and 15th both armies were comparatively quiet. The weather was fair from the 11th until the evening of the 15th, when a cold southeast rain set in with considerable fog, under cover of which the Union army quietly recrossed the Rappahannock river—"to get on 'tother side from where they had been at!" The rain came at the close of the fifth day after the cannonading began, and forty-eight hours after the close of the actual engagement. For verification of this statement see Harper's Pictorial History of the Civil War.

The fight at Chancellorsville opened on May 1, 1863 and there were sharp engagements on the 2d, 3d and 4th, with the weather all that could be desired. On the morning of the 5th a cool rainstorm dampened the ardor of the belligerents. The weather was fair for a period of seven successive days, during which time the movement of the army began and the battles were fought; then came a rain-storm, with northeast wind and all the characteristics of the ordinary spring rains of that section, covering a wide extent of territory. The interim between rains at that time was about twice as long as the average dry period for that season of the year in that region of the country.

The battles of the Civil War were fought, it should be remembered, in the seasons of the year and in the territory having the greater comparative frequency of rains. Looking over the tables of daily and monthly precipitation for the states wherein military operations were carried on one is impressed with the idea that a vast deal of the marching and fighting of the war must necessarily have been done in wet weather.

A good general would give much attention to the weather conditions and probabilities in making plans to strike an effective blow, and the main difficulty in that region would be to crowd in battles between rains. So in matter of fact the weather during the war had an effect upon battles, but there is no conclusive proof that battles had the slightest effect upon the weather.

Many of the surviving soldiers on both sides of the contest firmly believe that battles and storms came together with such frequency as to suggest if not prove the relation of cause and effect. This may be accounted for as a trick of the memory. Battles were great events

in the life of the soldier, and all the incidents associated therewith were deeply impressed on the mind. A heavy shower falling during the progress of a battle or at its close would be remembered because of its association with so conspicuous an event, while the many showers that fell during the dull routine of camp life would be forgotten. So in after years when the minor incidents have faded from the memory, the greater scenes and all their details are most vividly recalled.

Coincidents serve thus to aid remembrance of events which can have no possible relation to each other, as for example, the occurrence of a great storm on Christmas, Thanksgiving Day, New Years, Memorial Day, the Fourth of July or other notable anniversary. But something more than coincidents are required to establish the relation of cause and effect. Thousands of picnics, grove meetings and other out-door assemblages have been badly dampened or broken up by showers, but that fact does not quite sustain the theory that the concussion of air brought down the rain, or that we may break drouths by getting up mammoth picnics.

Battle Flag Day at Des Moines, August 10, closed with a refreshing shower, yielding more rain than had fallen within the preceding forty days; but this does not justify the conclusion that the shoutings of the veterans and the waving of the battle flags compelled the vapors to condense and come down, like Capt. Crockett's coon, without waiting to be fired at. The coincidence does not imply consequence.

While the question of rain-making by use of explosives was under consideration at Washington, the scientists of the Department of Agriculture made a thorough investigation of the subject, with all the records of the government at their command, and the conclusion reached was that there is no foundation for the opinion that days of battle were followed by rain any more than days when it was all quiet along the lines.

The experiments were made, however, under direction of men skilled in the work, and the heavens were bombarded by use of explosives vastly more powerful than gunpowder, but no rain followed under conditions that would justify the claim that it was caused by the shooting. The general verdict is shown by the fact that the experiments have been abandoned, and Congress could not be induced to make another appropriation for their continuance. And to-day the concussion theory is not supported by any scientist of note. While this fact is by no means conclusive, it throws the burden of proof upon those who adhere to the notion.

Some eminent scientific men of the past generation gave a qualified approval of the theory that great fires may, under certain conditions, give an initiative movement to storms. Espy in his Philosophy of Storms (1841), and in his second meteorological report (1850), cited numerous instances of rains which he thought were evidently started by brush fires. This belief in the theory was so strong that he urged Congress and State Legislatures to make provisions for experiments in that line. Mr. Espy urged that when the lower air is very moist a large fire may initiate a rising current that in cooling forms a cloud that would expand into the proportions of a local storm.

For a time it was believed that the great fire in Chicago, in 1871, caused a heavy rainfall which checked its further progress. But this was not sustained by the facts as given by Prof. I. A. Lapham, Assistant Chief Signal Officer U. S. A., who said: "During all this time—twenty-four hours of conflagration upon the largest scale—no rain was seen to fall, nor did any fall until four o'clock the next morning; and this was not a very considerable downpour, but only a gentle rain that extended over a large district of country, differing in no respect from the usual rains. It was not until four days afterward that anything like a heavy rain occurred. It is, therefore, quite certain that this case cannot be referred to as an example of the production of rain by a great fire."

It is generally agreed among scientists of note that to start a rain by large fires the air must be very moist and calm—in fact, it must be just ready to rain without assistance. And under such favorable conditions it would be impossible to prove that it might not have rained without a fire or any other artificial agency to start it.

In an address delivered in 1884, Mr. H. C. Russell, president of the Royal Society of New South Wales, and government astronomer, after referring to the old idea that clouds and storms could be dispelled by cannonading, which gave way after 1810 to the opposite view that such discharges cause rain, reviewed the Espy theory that great fires could be used to produce rain. He cited the records of forty-eight large fires, which led him to conclude that rain in no instance followed within forty-eight hours as a consequence of the fire. He calculated that in order to get an additional rainfall of sixty per cent at Sidney, a mass of air over an area of 52,000 square feet would have to be raised 1,800 feet every minute, and the total amount of coal necessary to do this would be nine million tons a day. These startling figures may give some idea of the probable cost and extent of a conflagration sufficiently great to break a drouth covering five hundred thousand square miles of territory, and keep it broken.

So even if it is fairly proven that under the most favorable conditions a big blaze may "fire off" a storm, it is wholly impracticable to adopt that method of rain-making for every-day use in a very dry time. You see when the air is supercharged with aridity, so to speak, it must take a tremendous amount of priming to start the water works!

There remains but one other method of artificial rain-making to be briefly considered in this article, viz: the system introduced in this country by Mr. Frank Melbourne, the so-called Australian rain-maker. The process is a closely guarded secret, but Mr. Melbourne explained that he employed certain chemicals which were mixed and converted into cloud-forming vapors. In making the gas, Mr. Melbourne further explained, the chemicals were "placed in a little box about as large as a tinker's stove, operated by a crank."

Two or three years ago Mr. Melbourne was inveigled into Western Kansas, and while there other parties purchased or appropriated his idea and improved upon his

method by using other chemicals and adding a small electric battery to the outfit—to raise thunder and lightning! Of course every well regulated summer shower must have that sort of an attachment. The battery used, however, would be insufficient to run a small-sized electric street car on a level track, but may be it is sufficient for use in "touching off" the celestial fireworks.

There are two drawbacks to this system: the rain-makers fix a time limit to their contracts, and they undertake to make rain while the sun shines, and in too dry weather. They should emulate the example of the "medicine men" of the Winnebago Indians, who break drouths by means of "rain dances," and when they begin operations they never let up until it rains, so they score a success every time

This new system must have its run. There is no use attempting to overthrow it by serious argument or reasons based upon known scientific principles. Experience must do the work of tuition, and in this case, as in scores of others, experience is a very high-priced teacher.

To thoughtful and intelligent people, who may be inclined to strike a bargain with one of these rain-making chemists, this single suggestion may be ventured: No real progress has been made, nor genuine scientific discovery introduced, through the methods of patent medicine street fakirs. When anything comes to you in that form, pretending to be a great discovery for promotion of human weal, spot it—it's a fake.

DROUGHT AND TILING.

MT. PLEASANT FREE PRESS: There is no information on any subject so valuable as the information that is given on the basis of intelligent practical experiment. Tiling is a subject which has for some years in the past, and will for years in the future, be a subject of vital interest to the farmers of Henry county,—and all other counties for that matter. The general supposition, or at least a very common supposition, is that tiling benefits level ground in wet weather, but has little to do with crop results in dry.

As an object lesson along this line, is the practical result of a system of tiling with dry weather, as well as wet, in view of the theory which lay behind it, on the farm of Mr. John Sullivan, of Canaan township. Twelve years ago Mr. Sullivan tiled his farm, six rods apart on the flat at a depth of three to five feet, three and one-half to five-inch tile in the bottom of the drain. The tile was laid as flat as it could be laid; less than three inches fall to forty rods. To cut off spouts, tiling was laid on top of ridges.

On the basis of his twelve years' experience and observation he would now tile the same ground at an average depth of two and one-half feet, with an average of smaller tile and closer together, and as level as possible to hold reserve moisture on the ground; the closer ditches would draw the surface water more perfectly; getting surface water off as quickly as possible is an important item in the early stages of crop cultivation; smaller tiles, ditches closer together and less fall of water tends to hold a reserve of moisture and gives proper aeration to the roots of the growing plants. Here is where excellence in surface cultivation joins with excellence in subsoil drainage. The sun warmth draws moisture from these reserves which proper tiling gives.

Mr. Sullivan says that upon ground thus prepared, he will this year have a crop from fair to good. While upon similar land where ditches were deeper and further apart with a greater fall of water, crops are a practical failure. He says many have laughed at his system, but he is now laughing at his corn, all the same.

A KEY TO WEATHER HISTORY.

THE INTER-OCEAN: A discovery has just been made which has in it, if really true, an important contribution to the storehouse of knowledge. According to Mr. J. Keuchler, of Texas, trees not only tell their own age but in the same ring-writing report upon the weather and productiveness of the several seasons of their respective lives. That the rings of a tree record its age has long been known. The inner ring of all is a kind of family Bible authority upon birth dates, but that of itself is not important, except as a matter of curiosity as to the age of that particular tree; but if Mr. Keuchler is right in his theory, and it is practicable to read the meteorological history of a country or section as far back as the birth of the oldest trees, then a new field of inquiry is opened up. It is as if a buried and forgotten library of scientific and historical knowledge had been unearthed.

It seems that this observant Texan cut down some trees which were more than 130 years old, but he was not content to count the annual rings. He noticed that the relative width of these rings in variations from year to year agreed exactly. This showed that some common cause had caused rapid or slow growth, as the case might be, from year to year. Just what that cause was, is the only open question. He thinks it could not have been anything but the weather. If the rainfall was insufficient vegetation of all kinds would be retarded, and just the reverse if it were ample. What else, he argues, could cause a general and uniform stimulation in one year and retardation in another?

The investigations of Mr. Keuchler for his locality covered 134 years, and, assuming that he has discovered the right key and gives the right interpretation to the writing in the wood, it follows that sixty of those years had been very wet, six extremely wet, seventeen average as to moisture, nineteen dry, eight very dry, and six extremely so. In many cases it would be of great utility to be able to thus measure the rainfall of the past and arrive at a law of average.

FLOOD TIMES AND DROUGHT.

MARSHALL TIMES-REPUBLICAN: Balfour Stewart is an accepted authority on meteorology and in a work of standard authority he says of the prevailing summer winds in the Mississippi valley:

"Since the origin of these winds is essentially oceanic and in their course northwards no mountain range crosses their path the whole of this extensive region enjoys a large but by no means excessive rainfall which taken in

connection with the temperature, renders the summer climate of these states one of the best to be met with anywhere on the globe for the successful prosecution of agricultural industries."

There is at once the science and the common sense of the matter. And these grand advantages conferred upon this region by Almighty power and wisdom fixing the law and rythm of the oceanic winds as they play over this great valley are utterly and absolutely beyond anything man can do to force, check or interrupt. It is inconceivable that tile drainage, increased tillage or cutting of forests can have any effect whatever on the movement of winds from the Gulf. The cause which seems to make all the difference between drought and flood is in the varying turns of the Gulf winds and the higher or lower temperature into which they advance, and just as these conditions vary there will be drought at one place or another in the valley. There is drought somewhere every year, but usually it is only local. Forty or fifty years ago excessively wet seasons immediately followed excessively dry ones, and *vice versa*, showing that range of change was as great then as now. Enough rain has fallen this year to have made magnificent crops if we could only have changed it so as to get in July the excess that came in April.

Beyond a doubt there were droughts and floods in this valley long before white men ever saw it, and these variations will continue through unnumbered centuries, but with every probability that they will not be general more than once in a generation or two.

WHEAT AS A STOCK FOOD.

The United States Department of Agriculture has issued a circular of information in regard to "wheat as a food for growing and fattening animals." A number of tables presenting the chemical aspects of the subject are given, and the following suggestions made:

"When wheat and corn are the same price per bushel, it is preferable to feed wheat and sell corn. First, because wheat weighs 7 per cent heavier per bushel than corn; secondly, because wheat is weight for weight an equally good grain for fattening animals; and thirdly, because there is much less value in fertilizing elements removed from the farm in corn than in wheat.

"There are certain points to be borne in mind when one is commencing to feed wheat. Our domesticated animals are all very fond of it, but are not accustomed to eating it. Precautions should consequently be observed to prevent accidents and disease from its use. It is a matter of common observation that when full-fed horses are changed from old to new oats they are liable to attacks of indigestion, colic and founder. If such results follow the change from old to new oats, how much more likely are they to follow a radical change, such as that from oats to wheat? For this reason wheat should at first be fed in small quantities. It should, when possible, be mixed with some other grain, and care should be taken to prevent any one animal from getting more than the quantity intended for it.

"These precautions are especially necessary when wheat is fed to horses, as these animals are peculiarly liable to colic or other disturbances of the digestive organs, accompanied or followed by laminitis. Cattle, sheep and hogs frequently crowd each other from the feeding troughs, in which case some individuals obtain more than their share, and may bring on serious or fatal attacks of indigestion.

"The best form in which to feed wheat is to roll or grind it into a coarse meal. It may then be fed alone, or mixed with corn meal or ground oats. When ground fine it is pasty and adheres to the teeth, gums, and cheeks so that it is not so readily masticated or eaten. In the form of a coarse meal it is relished by all animals, it is in a condition to be attacked by the digestive processes whether thoroughly masticated or not, and in most cases it gives the best results. Dr. Gilbert appears to have obtained better results from whole than from ground wheat when fed to sheep. Sheep feeders may, therefore, experiment with whole wheat, but wheat meal will certainly be found to give better results with all other kinds of animals.

"The number of pounds of live weight that may be produced by feeding a bushel of wheat will evidently vary according to the age and condition of the animal fed. Prof. Robertson, at the Ottawa experiment station, fed frozen wheat to hogs and secured from 9.1 to 15.46 pounds, live weight, from a bushel, the greater increase being from young, growing animals, and the smaller from those which were fattening.

"At the South Dakota experiment station the hogs fed ground wheat required 4.81 pounds, and those fed whole wheat required 4.91 pounds for 1 pound gain in live weight. The ground wheat fed returned 58.39 cents per bushel, the whole wheat, 55.83 cents; corn, 60 cents, and peas, 65.36 cents. The quality of pork obtained from ground wheat and corn was about equal, and was superior to that from whole wheat, peas, or mixed feed.

"From Canadian experiments it appeared that the feeding value of an equal weight of wheat is slightly in excess of that of corn; the South Dakota experiments have better results from corn. In general, the difference would probably not be very great, but it would undoubtedly be better to mix corn and wheat, or corn, wheat and bran, or corn, wheat and middlings."

SOME GOOD SUGGESTIONS.

Prof. Cleveland Abbe, of the U. S. Weather Bureau, in a letter to Dr. Chappell, says:

"Money should not be wasted on the rainmakers, but spent on wells, ditches, reservoirs, irrigation, windmills, and in other useful ways. An artificial pond and a grove of trees encircling it to break the wind, would save more water than the rainmakers can ever hope to bring down.

"The effect of a dry season is to perfect seed that will prosper in a similar dry season, and *vice versa*. The seed taken from a dry field ought to succeed next year if planted in a dry field; but, of course, still better if planted in a moist field. Ask your crop reporters what their experience is in this respect. The seed taken from the South and planted in the North gives a late variety, and *vice versa*. The seed carried from moist to dry climates

does poorly at first, but eventually a variety is evolved suited to the new climate. Thus the grains of Europe are gradually adapting themselves to the climate of our most arid regions, just as they have done in southern Russia.

"Each farmer does something to prevent the ill effects of a long drouth by saving for next year's seed that which ripened first in the dryest part of his farm. This is a lesson that I have learned from my study of 'climates and crops.' The variability of the climate is harder on the crops than its intrinsic severity. The seed is always trying to adapt itself to the climate, but, of course, is always a year behind."

SOME OBNOXIOUS WEEDS.

INFORMATION DESIRED ON THEIR INTRODUCTION AND SPREAD.

The writer has received numerous queries and specimens from many parts of the State with reference to some of our obnoxious weeds. In many cases the farmers fail to recognize the importance of taking immediate steps toward eradicating these plants on first appearance. Mistakes are frequently made in the identification of weeds, especially those of the weed laws. Plants may be sent at any time; they will be identified free of charge.

It is well known to many farmers that three legislatures have enacted weed laws, the last having passed the Russian Thistle law, which has stringent measures for eradication. Previous legislatures passed laws with reference to the Canada Thistle *(Cnicus arvensis)*, and Bull Thistle *(Cnicus lanceolatus)*.

CANADA THISTLE (*Cnicus arvensis*).—The leaves are from three to six inches long, ending with stiff, sharp bristles; flowers are purple, less than an inch long, and about one-half inch across, about half the size of the thistle so commonly found along the roadsides in Iowa, and Bull Thistle. The Canada Thistle has the habit of producing underground stems. This makes it difficult to exterminate. Cut the root stalk below the ground and allow none of the plants to make leaves.

BULL THISTLE (*Cnicus lanceolatus*).—Is a biennial, growing from two to four feet high, very bushy in its habit, having numerous branches; leaves about six inches long, the lobes producing sharp, spiny bristles, being much more numerous and formidable than in the Canada Thistle. The leaves are attached without a stalk, and run down along the stem. The "flower" is surrounded by a large number of small leaves or bracts, that end in a sharp spine. The "flowers" are about one and one-half inches high and purple in color. Every "flower" produces an enormous number of "seeds," which have attached to them numerous bristles, enabling the wind to carry them away. It was stated above that this weed is a biennial; that is, it only lives two years. The seed, when committed to the soil, germinates under favorable conditions, forming a spreading, leafy plant. The second season this plant sends up a stalk which grows into the bushy form; this flowers, and produces seed. This thistle is not difficult to destroy. All of the spread-plants should be cut off, none should be allowed to go to seed. This requires watchfulness on the part of everyone. Road overseers should see to it that the plant is removed from their enclosures. Street commissioners must not allow any in villages or cities.

HORSE NETTLE, OR SAND BRIAR (*Solanum carolinense.*)—Is a low, spreading, perennial plant, with deep, running roots. It grows to be a foot or more high, branching and somewhat straggling. The stem and midvein of the leaf are beset with sharp spines. The leaves are cut and more or less lobed. The blue or whitish blue flowers are borne in clusters from three to ten, and resemble those of the common potato, being star shaped and five lobed. The flowers are followed by green berries, but yellow when ripe. It is an exceedingly pernicious weed, being as tenacious as Canada Thistle.

BUFFALO BURR, OR SPINY NIGHT SHADE *(Solanum rostratum)*—Is an annual, growing from one to two feet high, bushy in its habit. The Buffalo Burr has prickly, hoary and pale green or yellowish, somewhat divided leaves. The branches are very spiny with similar leaves and burr-like berries. The yellow flowers separate it at once from Horse nettle. The calyx of the outer floral envelope so closely surrounds the berry that it appears a part of it. Each berry has a large number of black seeds. Treatment the same as the Bull Thistle.

PRICKLY LETTUCE (*Lactuca scariola*).—For many years was reported as occurring only near Cambridge, Mass., but since 1885 it has made very rapid progress and is found in nearly all of the states east of the Missouri and north of the Ohio rivers. It is an annual, having a somewhat prickly and bristly stem, the leaf below the mid-rib also being prickly. The small yellow flowers are bonre in erect heads, the "seeds" are elongated and have a long beak, which is crowned with stiff bristles. known as the pappus. The plant contains a copious supply of a milky juice like the cultivated lettuce. This weed is an annual, and can be destroyed easily by cutting off the plants below the ground before the seed is mature. This is almost certain to occur in eastern and central Iowa, especially in lawns and along roadsides, and is one of our worst weeds.

MARSH ELDER (*Iva xanthiofolia*).—Coming in from the west and northwest is a coarse annual weed known as the Marsh Elder. The leaves in shape much resemble those of a cocklebur, except that they are covered with a minute, soft down. The plants are frequently from six to ten feet tall, and bear flowers much as rag weed does.

In order that the writer may be able to determine how far and fast these weeds have spread in Iowa he asks the co-operation of all who are interested to send him the above weeds; state how long you have been familiar with them and whether they are spreading.

L. H. PAMMEL,
Botanist Experiment Station.
Iowa Agricultural College, Ames, Iowa.

SOME HISTORIC DROUTHS.

There have been drouths and drouths in all ages and countries. In the year 310 A. D. hardly a drop of water fell in England, and 40,000 people died of famine.

The seven years of drouth and famine in Eygpt, recorded in Genesis, began in the year 1708, B. C.

In 954 a drouth began in Europe, lasting four years. The summers were intensely hot and the famine prevailed everywhere; 3,000,000 died of hunger.

In 1771 an unprecedented drouth prevailed throughout India. Scarcely any rain fell for a year, and hundreds of thousands died of famine, whole districts being depopulated.

In 1837 drouth and intensely hot weather prevailed in Northwest India. Over 800,000 persons perished from famine. Similar destruction was wrought by the same causes in 1865 and 1868, over 2,000,000 persons perishing of hunger in the two years.

And yet those countries are not all dried up; nor is it true that those great drouths were caused by tiling the lands or draining off the local ponds. In fact, it can not be shown that any such visitation was caused by human agency.

OCTOBER'S PAST WEATHER RECORD.

DES MOINES—SIXTEEN YEARS' RECORD.

TEMPERATURE.—Mean or normal, 53°. The warmest October was that of 1879, with an average of 60°. The coldest October was that of 1888, with an average of 49°. The highest temperature during any October was 87° on the 1st, 1892. The lowest temperature during any October was 14° on the 25th, 1887. Average date on which first "killing" frost occurred (in autumn), October 10th. Earliest on record, September 12th.

PRECIPITATION.—Average for the month, 3.26 inches. Average number of days with .01 of an inch or more, 9. The greatest monthly precipitation was 6.45 inches in 1881. The least monthly precipitation was 0.22 inches in 1892. The greatest amount of precipitation recorded in any twenty-four consecutive hours was 3.67 inches on the 7th, 1884. The greatest amount of snowfall recorded in twenty-four consecutive hours (record extending to winter of 1884-5 only) was 15 inches on October 21st, 1888.

CLOUDS AND WEATHER.—Average number of clear days, 13 Average number of partly cloudy days, 11. Average number of cloudy days, 7.

WIND.—The prevailing winds have been from the northwest. The highest velocity of the wind during any October was 42 miles on October 16th, 1878.

DAVENPORT—TWENTY-THREE YEARS' RECORD.

TEMPERATURE.—Mean or normal, 52°. The warmest October was that of 1879, with an average of 61°; the coldest October was that of 1887, with an average of 48°. The highest temperature during any October was 87°, on the 2d, 1891; the lowest temperature during any October was 17°, on the 25th, 1887. Average date on which first "killing" frost occurred (in autumn), October 14th.

PRECIPITATION.—Average for the month, 3.04 inches. Average number of days with .01 of an inch or more, 8. The greatest monthly precipitation was 7.17 inches, in 1884; the least monthly precipitation was 0.55 inches, in 1892. The greatest amount of precipitation recorded in any 24 consecutive hours was 4.12 inches, on the 6th and 7th, 1884. The greatest amount of snowfall recorded in 24 consecutive hours (record extending to winter of 1884-5 only), was "trace," on the 31st, 1885.

CLOUDS AND WEATHER.—Average number of clear days, 11; average number of partly cloudy days, 11; average number of cloudy days, 9.

WIND.—The prevailing winds have been from the southwest. The highest velocity of the wind during any October was 60 miles, on the 16th, 1880.

KEOKUK—TWENTY-THREE YEARS' RECORD.

TEMPERATURE—Mean or normal, 54°. The warmest October was that of 1880, with an average of 62°. The coldest October was that of 1873, with an average of 49°. The highest temperature during any October was 90°, on the 1st, 1893. The lowest temperature during any October was 20°, on the 25th, 1887. Average date on which first "killing" frost occurred (in autumn), October 14th. Average date on which last "killing" frost occurred (in spring), April 9th.

PRECIPITATION—Average for the month, 3.24 inches. Average number of days with .01 of an inch or more, 8. The greatest monthly precipitation was 8.01 inches, in 1881. The least monthly precipitation was 0.28 inches in 1879. The greatest amount of precipitation recorded in any 24 consecutive hours was 2.23 inches, on October 16th, 1873.

CLOUDS AND WEATHER.—Average number of clear days, 10. Average number of partly cloudy days, 12. Average number of cloudy days, 9.

WIND.—The prevailing winds have been from the southwest to northwest. The highest velocity of the wind during any October was 48 miles, on the 15th, 1880, and 17th, 1883.

SIOUX CITY—FIVE YEARS' RECORD.

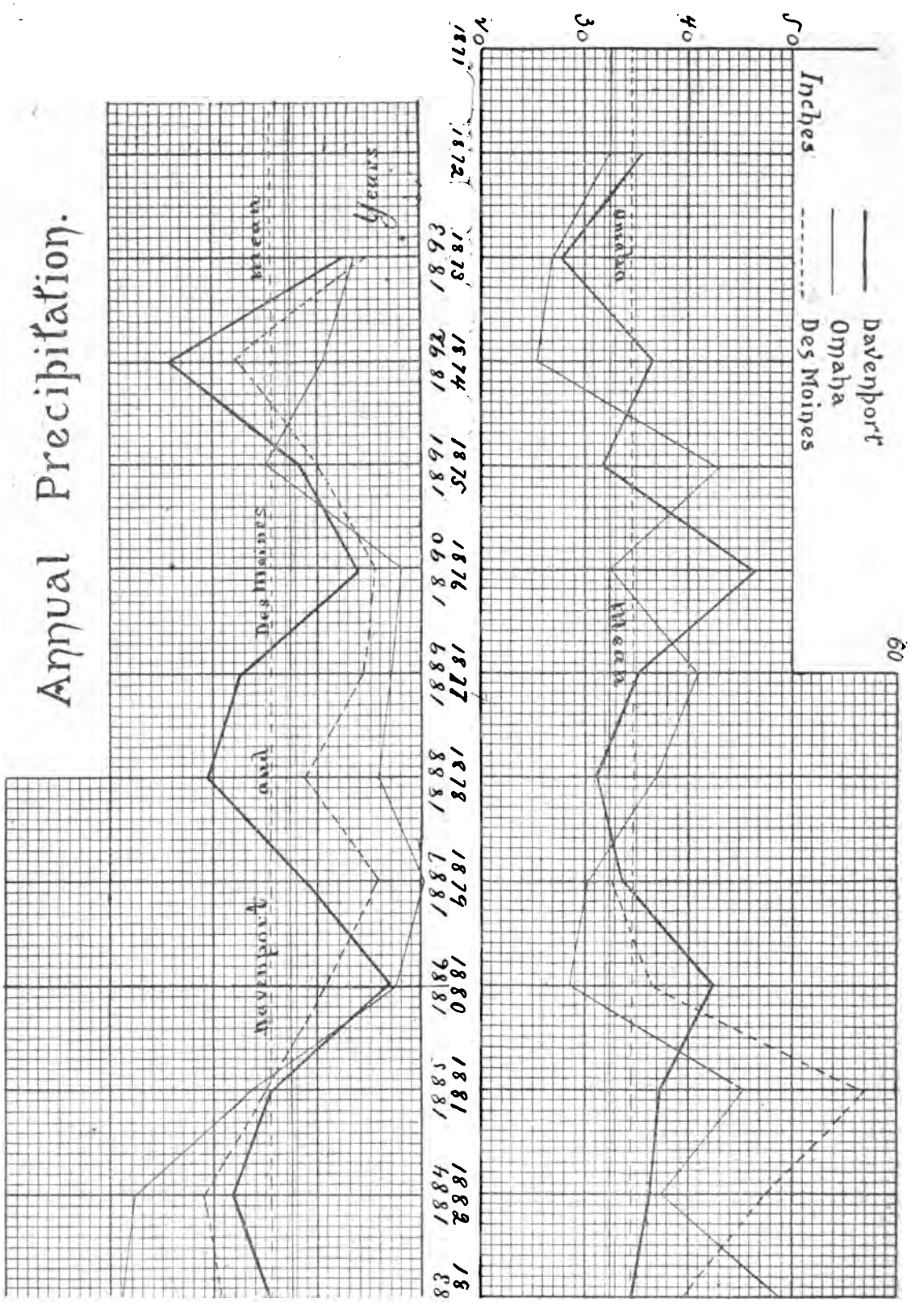
TEMPERATURE.—Mean or normal, 52°. The warmest October was that of 1892, with an average of 55°; the coldest October was that of 1890, with an average of 50°. The highest temperature during any October was 90°, on the 1st, 1892; the lowest temperature during any October was 18°, on the 24th, 1892. Average date on which first "killing" frost occurred (in autumn), September 24th.

PRECIPITATION.—Average for the month, 1.40 inches. Average number of days with .01 of an inch or more, 7. The greatest monthly precipitation was 3 04 inches, in 1891; the least monthly precipitation was 0.21 inches, in 1889. The greatest amount of precipitation recorded in any 24 consecutive hours was 1.92 inches, on 2d and 3d, 1891. The greatest amount of snowfall recorded in 24 consecutive hours (record extending to winter of 1889-90 only), was "trace," on the 6th, 1891.

CLOUDS AND WEATHER.—Average number of clear days, 15; average number of partly cloudy days, 8; average number of cloudy days, 8.

WIND.—The prevailing winds have been from the northwest. The highest velocity of the wind during any October was 46 miles, on the 1st, 1891.

Take notice of the kind of soil, location, slope, and exposure of the fields wherein the best corn was produced this year. We should like to hear from the corn fields this season, for they will give some good hints. Observe the effects of tile drainage, and the protection from hot winds afforded by groves and timber belts.


Annual Precipitation.
Davenport
Omaha
Des Moines
Inches
20
30
40
50
60
Omaha
Des Moines
Davenport
Years
1871
1872
1873
1874
1875
1876
1877
1878
1879
1880
1881
1882
1883
1884
1885
1886
1887
1888
1889
1890
1891
1892
1893

A STUDY IN COMPARATIVE RAINFALL.

From the annual reports of the Iowa Weather and Crop Service the writer has collected and tabulated the data on three of our important Weather Bureau stations, viz, Davenport, Des Moines and Omaha:

YEARS.	TOTAL PRECIPITATION.		
	Omaha.	Davenport.	Des Moines.
1871	32.79	.....	.....
1872	32.48	36.44	.....
1873	27.04	28.08	.....
1874	25.75	36.79	.....
1875	42.89	31.99	.....
1876	32.51	46.82	.....
1877	40 95	35.10	.....
1878	37.05	31 21	.....
1879	30.31	33.89	32.82
1880	28.52	42.73	36.66
1881	45.74	37.28	56.81
1882	37.68	36.60	47.60
1883	48 92	34.59	39.69
1884	47.68	38.11	41.14
1885	36.68	34.35	35.03
1886	22.67	23.15	29.53
1887	19.92	31.23	24.60
1888	24.22	40.49	31.15
1889	22.97	37.61	25.90
1890	22.08	26.10	24.74
1891	34.92	31.45	30.14
1892	29.50	44.15	37.92
1893	26.66	27.33	25.64
Means	32.60	34.79	34.62

Davenport may be taken as a station representative of the great Mississippi valley, and it is our purpose in this brief sketch to use its rainfall record as a basis of comparison to bring out a characterizing feature of the climate over the great slope which rises gradually to the Rocky Mountains. The graphical method of representation is used in order to present to the eye the matter in as strong a light as possible. See diagram page 10.

The trace for Davenport is in heavy line, Omaha in light line, and Des Moines in broken line. The mean annual precipitation for Omaha is shown by the full horizontal line, while that for the other two stations, being so nearly the same in amount, may be approximately given by the one horizontal broken line. On examining the trace for Davenport one sees that the departures from the mean are comparatively small and change sign frequently; and while there may be evidence of a period in which either wet or dry conditions persist, these conditions could not be characterized as excessive. The distinguishing feature may be said to be uniformity—a prime quality in the rainfall of any region. On the other hand, the traces for both Des Moines and Omaha show wide departures. For example, the rainfall at Des Moines for 1881 is 56 81 inches, an excess over the mean of 22.19 inches, an amount nearly equal to the total rainfall for the years 1887 and 1890; while for the period 1886 to 1893 inclusive the mean value has been reached only once. In the case of Omaha we find that in the period of five years, 1886 to 1890 inclusive, the rainfall never exceeded 22 97 inches, while once in that time it fell below 20 inches. Taken collectively the evidence shows the existence of a wet period for the three stations covering the interval 1879 to 1885. At both Des Moines and Omaha the rainfall continues well above the mean for six years. This was the "booming" era of the west, particularly in Kansas and Nebraska. From 1886 to 1893 inclusive the traces for Omaha and Des Moines show the existence of a persisting dry period. General conclusions should not as a rule be drawn from observations covering so short a time as that involved here; but if there is contained in these results a hint of what may be said to be the characterizing feature of the precipitation on the great slope, it will be to the effect that it is to a greater or lesser degree a persisting extreme.

In addition it might not be out of place to suggest that if the rainfall is affected to any considerable degree by solar influences which might become apparent at the times of greatest sunspot frequency our traces would not lead us into any great confusion. If, for example, the time of greatest sunspot frequency should occur at the time of a persisting wet period as in 1881, an excessive rainfall would be looked for. On the other hand, if it occurred as it did in 1892 in a persisting dry period, it might carry our trace above the mean for a short time. If these are cases of mere coincidence they are certainly worthy of mention.

ALBERT L. ARNER.
Physical Laboratory State University of Iowa.

AN AUGUST METEOR.

On the morning of August 29th, at about 4 o'clock, a brilliant meteor was observed and heard by persons residing in Newton, Reasnor, Albia and Afton.

Mr. A. Lufkin, voluntary observer at Newton, writes as follows:

"A very brilliant meteor passed south of us at 3:50 A. M. Wednesday, 29th, and exploded, making a heavy, muffled report like a blast or explosion of dynamite. Some of the persons who heard it near the business part of town, thought a safe had been blown up. Hundreds of persons in this town and vicinity heard it, and many saw the light. One man, "a watcher," saw it burst like a big rocket; he turned and went into the house, and after he got in heard the explosion and felt it shake the house. The concussion was so great that it shook the house and rattled the windows in no gentle manner.

A man at Reasnor, ten miles south of this place, sent me word that he was at the creamery early, and saw it explode, and said it was northeast from him, and if he was correct it may have fallen in the east part of this county or the west part of Poweshiek county."

Mr. Cal Koontz, observer at Albia, reports the same meteor, or a fragment of it, passing over or near that place at about 4 A. M. on the 29th. Houses were shaken as by an earthquake, and the sound of an explosion was heard by many people.

An Afton dispatch, dated August 30th, says: "Yesterday morning, August 29th, while John Sales was harnessing his team preparatory to going to Creston he saw a meteor fall within a short distance of him. His team became frightened at the noise made by the descending meteor and came near running away. An examination showed

that it was a fragment of a meteor, about the size of a half bushel measure, and was so hot that it could not be handled. It made an exceedingly bright light. Sales had a meteor fall on his farm in Johnson county about seventeen years ago, and still has the curiosity on exhibition at the Afton Normal College." This was undoubtedly a fragment of the meteor that shook up Albia and Newton.

AUGUST WEATHER REPORT.

The month of August was hot and generally dry, bringing but temporary relief from the withering drouth which prevailed through the summer months. The mean temperature for the State was 74 6°, which is an average daily excess of 3.6° above the normal for August. The first decade brought very high temperatures, almost unclouded skies and but little more than a trace of rain. This heated term culminated in light showers, extending over the larger part of the State. The highest temperature recorded for the month was 108° at Logan and Glenwood on the 10th; lowest temperature 38° at Elkader and Mason City on the 3d and at Iowa City on the 4th. The temperature range for the State was 70°.

The average rainfall was 1.58 inches—2.02 inches below the normal amount. The bulk of the rainfall came within the second decade, 10th to 20th. Newton reports the highest measurement—4.53 inches; the least amount was a trace at College Springs.

The following table gives, as a basis of comparison, the mean temperature and total precipitation for the month of August at the stations named, for the years from 1872 to 1894 inclusive:

YEARS.	MEAN TEMPERATURE, DEGREES.					PRECIPITATION, INCHES.				
	Des Moines.	Davenport.	Keokuk.	Omaha.	Sioux City.	Des Moines.	Davenport.	Keokuk.	Omaha.	Sioux City.
1872	....	74	77	75	....	....	9.38	0.97	1.78	.....
1873	....	78	78	76	....	.....	0.51	0.54	1.60	.....
1874	....	74	76	78	....	.....	3.68	3.87	2.08	.....
1875	....	69	70	70	....	.....	1.73	3.83	7.77	.....
1876	....	75	76	74	....	.....	4.27	4.03	6.27	.....
1877	....	72	74	72	....	.....	3.21	2.52	3.13	.....
1878	78	74	78	76	....	2.21	5.07	5.27	2.48	.....
1879	73	72	75	75	....	1.98	4.33	4.57	1.51	.....
1880	72	75	78	76	....	6.69	5.50	3.81	7.10	.....
1881	78	77	80	80	....	5.29	0.83	0.86	1.65	.....
1882	71	72	73	73	....	3.14	2.29	3.09	0.95	.....
1883	70	70	71	72	....	2.83	1.02	1.32	3.39	.....
1884	69	70	72	70	....	3.84	3.84	2.74	7.07	.....
1885	69	68	71	70	....	5.10	12.68	5.98	4.53	.....
1886	77	74	78	72	....	1.10	2.67	5.90	2.53	.....
1887	72	72	75	72	....	2.66	3.23	2.38	3.94	.....
1888	69	70	72	72	....	4.52	2.79	2.07	3.44	.....
1889	72	72	73	74	73	2.25	1.11	0.95	2.90	1.19
1890	70	70	71	70	69	3.35	1.66	1.77	1.02	3.64
1891	70	70	71	72	70	4.22	5.54	6.70	2.02	3.54
1892	72	73	75	73	72	2.45	1.53	1.07	2.50	4.14
1893	70	72	72	71	70	1.60	1.12	1.16	3.62	5.85
1894	76	75	77	78	75	1.89	2.02	0.51	0.36	1.68
Means	72	71	73	73	72	3.24	3.73	2.97	3.18	3.34

SUMMARY OF WEATHER CONDITIONS.

BAROMETER—Mean pressure for the month, 30 01 inches. Highest observed, 30.25 inches, at Cresco, on the 4th. Lowest observed, 29.77 inches, at Sioux City, on the the 6th. Range for the State, 0.48 inches.

TEMPERATURE — Monthly mean, as deduced from sixty-nine voluntary observers' reports, 74.6°. Highest monthly mean, 80.8°, at Glenwood. The lowest monthly mean, 68.9°, at Osage. The highest temperature reported was, 108°, at Logan and Glenwood, on the 10th. The lowest temperature reported was 38°, at Elkader and Mason City, on the 3d, and Iowa City on the 4th. The average daily maximum 89.4°. The average daily minimum was 60.1°. The average monthly maximum was 101.8°. The average monthly minimum was 46.3°. The greatest monthly range was 66°, at Atlantic. The lowest monthly range was 41°, at Ft. Madison. Range for the State, during the month, 70°.

RAINFALL—Average for the State, as determined from seventy-four voluntary observers' reports, 1.58 inches. The greatest amount reported was 4.53 inches, at Newton. The least amount reported was a trace at College Springs. The average number of days on which .01 inch or more rain fell was 4.3. The average number of cloudy days, 2.1. Partly cloudy, 8.1. Clear, 20.6.

HALO—Solar, Hopeville, 1st.

HAIL—Hopkinton, on the 16th.

THUNDER-STORMS were reported from some point in the State on the following dates: 1st, 10th, 11th, 12th, 13th, 14th, 15th, 16th, 17th, 20th, 22d, 23d, 24th, 25th.

AURORA—Alta, 1st and 2d; Cedar Rapids, 25th; Cresco, 19th; Delaware, 20th; Elkader, 19th; Grand Meadow, 20th; Mason City, 19th; Osage, 17th; Williams, 3d.

FROST, LIGHT—Cresco, 3d; Forest City, 3d, 4th; Logan, 24th.

LUNAR RAINBOW—Greenfield, on the 10th.

ATMOSPHERIC PRESSURE.

STATIONS.	Mean reduced barometer.	EXTREMES.			
		Highest reduced barometer.	Date.	Lowest reduced barometer.	Date.
Cedar Rapids	30.00	30.22	4	29.80	1
Clarinda	30 02	30.23	3	29.83	13
Cresco	.....	30.25	4	29.86	6
Davenport	30.01	30.21	5	29.79	1
Des Moines	30.02	30.24	4	29.85	11
Keokuk	30.01	30.23	4	29.81	1
La Crosse (Wis.)	30.02	30.24	21	29.81	6
Omaha (Neb.)	30.01	30 24	4	29.78	13
Sioux City	29.98	30.22	3	29.77	6
Means	30.01	30.25	....	29.77	....

WIND MOVEMENT.

STATIONS.	Number of miles.	Maximum velocity.	Direction.	Date.
Davenport	4,752	28	N	18
Des Moines	4,204	25	W	14
Keokuk	3,893	24	SW	10
La Crosse (Wis.)	4,024	18	N	2
Omaha (Neb.)	4,789	36	NW	16
Sioux City	6,493	32	N	15

OBSERVER'S NOTES.

Clinton—DR. LUKE ROBERTS: August, 1894, took up the task of continuing the drouth, which July had inau-

gurated, and successfully conducted the withering visitant through Clinton county for ten days, when it threw half of an inch of water in its face, and somewhat checked its blighting propensity. Repeating this cold water treatment on the 13th and 17th, the drouth came to a halt to the great delight and profit of all. But a failure to continue seasonable showers brought on a relapse, and the month closed with a dryness about equal to that at its commencement.

Although we had no rain after the 17th there were mitigating conditions that made the absence of rain less damaging than had been the case previous to the 10th. Copious dews and cool nights; shorter days and more humid atmosphere, and most of the time a hazy or smoky condition prevaled to the extent of intercepting the rays of the sun and not permitting its full radiance to strike the earth. The month was deficient in rainfall, there having been only 1.74 inches. A normal precipitation for August is 2.27 inches.

The temperature of the air was warm throughout, exceeding normal by 2.3°. The mean temperature was 72°. But twice in the last sixteen years has August exceeded it. In 1886 it was .9 of a degree higher, and in 1881 2.3° higher. The maximum temperature reached 100° on the 8th; this was 3.1° above normal. The minimum 46° or 13° above normal. The warmest day was the 9th—temperature 81.3° or 1° above normal. The coldest day was the 3d—temperature 61.2° or 3.1° above normal.

The mean temperature for June, July and August, 1894, was 73.7°. This is higher than any corresponding period for the last sixteen years. A normal for these three months for the years named is 70.8°, and the highest previous to 1894 was 72.8°, occurring in 1887. Like comparisons for the months of July and August gives, for 1894, 1.9° above normal.

The prevailing direction of the wind was northeast, and its maximum velocity only 12 miles an hour. Its total movement was 2,140 miles. While this was not the lowest for August wind movement, it was below normal, many periods of calm occurring.

There was very little thunder and lightning during August. During the early hours of the 17th, from 1 to 6 o'clock, intense lightning and loud thunder furnished entertainment to those not lost in sleep. The shattered trees and telegraph poles, dead cattle and ashes of consumed barns and hay, are sad but truthful reminders of the power for destruction of this electric element. The most serious loss by this storm was the destruction of two barns and their valuable contents, such as hay and farming utensils, etc., belonging to Burt Smith, about four miles west of the city, on the second avenue road.

The water in the Mississippi river is at low water mark and is not navagable for boats of much size. The prospects of a rise seemed remote as the month gave place to September.

Newton—A. LUFKIN: At 3:50 A. M., Wednesday, August 29th, a large meteor passed south of us and exploded like an immense rocket and with a sound of a heavy blast which shook the houses and rattled the windows. Hundreds of persons heard it, and many saw the light from it.

College Springs—A. A. BERRY: The dryest month ever known in Page county, the rainfall not being sufficient to measure. No pastures. Not a cloudy day in the month. Burning sunshine, intense heat, tells the story. All stock being fed. Small grain better than expected.

ERRATA.

Fayette: Total rainfall for May, 1.91 inches instead of 1.96 inches.

Hopkinton: Total amount for May 2.73 inches, instead of 2.93.

Lowest mean temperature for July summary should read 70.7 at Hopkinton, instead of 72.6 at Sibley.

BELATED REPORTS.

Fayette. July, 1894. Mean temperature, 75°; maximum temperature 107°, on the 26th; minimum, 42°, on the 7th. Total rainfall, 0.21 inches. Number of rainy days, 1; cloudy days, 1; partly cloudy, 5; clear, 25. Thunder-storms on the 29th and 31st. Aurora on the 7th.

SOLAR OBSERVATIONS, JULY, 1894.—ALTA, IOWA.

BY DAVID E. HADDEN.

Date.	CENTRAL TIME.	NUMBER VISIBLE		Faculæ.	Definition.	REMARKS.
		Groups.	Spots.			
1	5:30 P. M.	4	....	4	Fair.	Small prominence E. limb. Several fine ones on W. limb.
2	5:30 P. M.	5	14	4	Poor.	New group on SE. limb, prominent faculæ W. and SW. limbs.
3	5:45 P. M.	6	18	4	Fair.	New group by rotation in extensive region of facula. Very fine large prominence along W. and SW. limbs.
4	5:00 P. M.	6	28	3	Good.	New spots formed in groups SE. A few small prominences on W. and SW. limbs.
8	5:00 P. M.	9	35	3	Good.	
9	5:30 P. M.	8	38	5	Fair.	Facula by rotation SE. and E. limbs.
10	5:30 P. M.	8	30	5	Fair.	New group by rotation S. latitude.
11	5:30 P. M.	8	....	3	Poor.	A new small group formed in SE. quadrant.
12	5:30 P. M.	11	44	3	Good.	New groups E. and SE. limbs.
13	5:35 P. M.	10	48	4	Good.	New spots in groups SE. Small low prominences on N. and along E. limbs.
15	5:45 P. M.	11	60	3	Fine.	A large group near W. limb. Also large double group with numerous spots in SE. quadrant. A group of minute spots in region of facula near NE. limb.
16	5:25 P. M.	10	50	3	Good.	The groups are in about same relative positions as yesterday. Fine large cloud-like prominence on SW. limb. Smaller one on E. limb.
17	5:30 P. M.	6	40	4	Fair.	Prominent facula SE. quadrant. Fine large prominence on W. limb.
18	5:20 P. M.	7	75	4	Good.	Many of the spots are quite small. Two large spots W. of meridian S. latitude.
20	5:40 P. M.	7	. ..	4	Good.	New group on edge of E. limb.
22	4:30 P. M.	9	40	3	Fine.	New group SE. limb.
23	5:30 P. M.	7	....	4	Fair.	Extensive facula on W. limb. Extensive prominence along W. limb, also prominences on SW. and W. limbs.
24	5:30 P. M.	5	*20	3	Fair.	
29	5:20 P. M.	5	6	5	Fair.	New group E. limb.
30	5:40 P. M.	4	12	5	Fair.	Large group on E. limb. Extensive low prominence W. limb.

*About.

METEOROLOGICAL DATA FOR AUGUST, 1894.

STATIONS.	TEMPERATURE OF THE AIR. (IN DEGREES FAHRENHEIT.)								Precipitation in inches—Monthly.	Prevailing direction of wind.	No. of cloudless days.	No. of partly cloudy days.	No. of cloudy days.	No. of rainy days (.01 inch or more).	No. of thunder storms.
	Monthly mean.	EXTREMES.						Monthly range.							
		Mean maximum.	Mean minimum.	Maximum.	Date.	Minimum.	Date.								
Afton	77.3	93.5	61.1	104	8, 9	49	3	55	0.12	SW	26	3	2	2	
Albia	75.7	91.7	60.0	104	9	48	3, 4	56	0.50	S	9	17	5	3	
Algona	72.9	.....	.....	96	7, 8	51	3	45	1.77	NW	19	11	1	4	
Alta	74.1	87.6	60.5	102	9	48	3	54	2.87	SE	23	6	2	6	
Amana	73.5	87.7	59.3	103	9	45	3, 4	58	1.98	SW	19	8	4	4	
Ames (Hellman)	.....	.....	.....	.....	.....	.....	.....	.....	2.10	.....	.....	.....	.....	.....	
Atlantic	74.5	93.0	56.0	105	10	39	4	66	0.56	S	16	11	4	3	
Audubon	74 4	89.8	59.0	102	10	42	4	60	1.31	S	10	18	3	4	
Belle Plaine	74.4	89.5	59.3	103	9	43	3	60	1.34	SW	17	12	2	4	
Bonaparte	77.1	94.1	60.0	106	9	46	4	60	1.60	.....	.....	.....	.....	6	
Carroll	72.3	87.4	57.2	100	9	41	4	59	1.61	.....	18	13	0	8	
Cedar Falls	75.0	92.3	57.7	102	9	40	4	62	1.95	S	29	2	0	3	
Cedar Rapids	74.7	85.8	63.5	101	9	47	4	54	2.51	SW	25	4	2	6	
Centerville	79.0	95.5	62.6	106	9	50	5	56	0.65	SW	29	2	0	1	
Clarinda	77.6	90.8	64.4	101	11	50	3	51	0.23	S	25	4	2	4	
Clinton	73.6	88.0	59.2	100	8	46	3, 4	54	2.74	NE	11	17	3	3	1
College Springs	77.8	93.2	62.5	106	11	49	4	57	T.	S	27	4	0	0	
Corning	74.9	88.4	61.1	98	11	40	4	49	0.37	SE	27	3	1	2	
Cresco	72.0	85.8	58.2	101	8	42	3	59	1.03	SW	21	8	2	4	
Davenport	75.0	86.3	62.8	98	9	49	3	49	2.02	SW	9	17	5	3	
Decorah	72.8	87.6	58.0	102	7, 8	40	3	62	0.53	.....	26	4	1	3	
Delaware	70.7	.....	.....	103	8	42	3	61	1.77	NW	25	6	0	4	
Des Moines	76 0	83.6	63.4	100	9	47	4	53	1.89	SW	25	6	0	4	
Dubuque	74.2	87.2	61 3	100	8	46	3	54	1.32	N	26	0	5	3	
Elkader	73.0	89.9	56.0	103	8	38	3	65	1.84	N	16	14	1	3	
Emmetsburg	70.2	84.5	61.5	102	8	49	3	53	2.09	SW	25	4	2	8	
Fayette	73 5	89.8	57.1	103	7	39	3	64	1.44	SW	.....	.....	.....	4	
Forest City	72.6	87.7	57.5	101	8	44	4	57	0.87	S	23	3	5	3	
Ft. Madison	78.4	.....	.....	100	11	59	3, 4	41	0.55	SW	19	6	6	2	
Glenwood	80.8	96.6	65.1	108	10	48	3	60	3.02	S	23	8	0	2	
Grand Meadow	72.1	.....	.....	97	8	54	28	43	1.03	SW	5	26	0	2	
Greenfield	77.6	92.8	62.3	102	9	49	4	53	0.59	S	25	4	2	3	
Grundy Center	74.0	86.8	59.2	98	8, 9	42	2, 3	56	1.71	NW	22	7	2	3	
Hampton	72.8	87.1	58.5	101	8	44	3	57	2.68	SW	23	8	0	3	
Hawkeye	.....	.....	.....	.....	.....	.....	.....	.....	0.83	.....	.....	.....	.....	6	
Hopeville	77.0	90.7	63.3	101	10	50	3	51	0.75	SW	5	26	0	5	
Hopkinton	75.0	84.6	61.5	97	7, 8	45	3	52	4.24	SE	.....	.....	.....	4	
Humboldt	.....	.....	.....	.....	.....	.....	.....	.....	1.57	N	28	3	0	6	
Independence	72.2	87.5	56.9	100	9	42	3	58	2.10	SW	13	17	1	3	
Indianola	76.5	92.0	61.0	103	9	43	3	60	0.95	SW	.....	.....	.....	2	
Iowa City	71.9	86.6	57.2	99	9	44	4	55	2.40	SW	19	9	3	4	
Iowa Falls	72.0	88.3	55.6	98	7	38	4	60	1.56	.....	.....	.....	.....	5	
Jefferson	76.6	93.8	59.5	105	10	52	2, 6	53	2.38	SW	14	17	0	6	
Keokuk	77 0	89 0	65.0	100	9	52	4	48	0.51	SW	22	7	2	5	
Keosauqua	76.4	89.5	63.2	104	9	50	4	54	0.99	.....	.....	.....	.....	4	
Knoxville	75.8	89.6	62.1	100	29	49	4	51	2.62	SW	14	13	4	4	
Logan	75.2	93.6	56.7	108	10	.....	.....	.....	1.83	S	22	5	4	6	
Le Claire	.....	.....	.....	.....	.....	.....	.....	.....	1.57	.....	.....	.....	.....	5	
Marshalltown	73.9	89.0	58.8	102	9	42	3	60	1.20	SW	17	7	7	3	
Mason City	72.2	89.6	54.8	102	7	38	3	64	0.98	.....	.....	.....	.....	3	
Mechanicsville	72.6	86.6	58.5	101	9	45	3	56	2.41	SW	23	5	3	5	
Monticello	73.0	86.1	60.0	99	9	44	3, 4	55	3.42	NW	25	6	0	5	
Mt. Pleasant	72.4	.....	.....	.....	.....	.....	.....	.....	0.06	SW	23	4	4	3	
Newton	75.2	88.6	51.8	104	9	49	3	55	4 53	SW	14	15	2	5	
North McGregor	.....	.....	.....	.....	.....	.....	.....	.....	1.32	.....	.....	.....	.....	5	
Ogden	77.1	91.1	63.1	105	9	45	3	60	2.28	SE	27	1	3	6	
Omaha (Neb.)	78.0	90.0	66.1	99	10	53	3	46	0.36	S	17	13	1	4	
Osage	68.9	.....	.....	99	8	52	3	47	2.18	NW	21	8	2	3	
Oskaloosa	74.5	88.7	60.3	103	9	44	4	59	.....	SW	28	0	3	.....	
Ottumwa	76.2	89.4	63.2	102	9	50	4	52	1.32	W	25	6	0	5	
Ovid	78 8	95.6	61.9	105	9	46	2	59	0.35	SW	21	8	2	3	
Panama	74.8	89.0	60.6	100	9	47	4	53	1.63	SW	28	3	0	4	
Richland	74.3	.....	.....	107	9	53	27	54	2.22	.....	6	16	9	7	
Rockwell City	.....	.....	.....	.....	.....	.....	.....	.....	1.75	.....	24	6	1	5	
Sac City	75.9	88.9	63.0	103	9	57	4	46	3.60	SW	20	9	2	4	
Seymour	77.5	93.3	61.7	101	9	47	3	54	1.59	SW	21	3	7	5	
Sibley	71.4	86.9	55.9	97	8	43	3	54	0.97	S	24	6	1	5	
Sioux City	75.2	88.2	62.1	102	8	47	3	55	1.68	S	22	8	1	7	
Spirit Lake	75.0	88.9	61.0	104	8	44	3	60	1.11	NE	23	4	4	4	
Sutherland	72.9	87.7	58.1	102	9	44	4	58	2.90	S	.....	.....	.....	5	
Vinton	73.4	.....	.....	.....	.....	.....	.....	.....	2.28	SW	29	1	1	3	
Washington	74.2	88.5	60.0	102	9	46	3	56	1.89	NE	.....	.....	.....	5	
Webster City	74.7	.....	.....	104	8	46	3	58	1.95	SW	19	9	3	3	
Williams	72.3	.....	.....	103	7, 9	50	16	53	1.69	SW	25	4	2	5	
Winterset	76.3	92.1	60.5	103	9	47	3	56	0.53	SW	15	7	9	5	
Means	74.6	89.4	60.1	101.8	....	46.3	.....	55.4	1.58	SW	20.6	8.1	2.1	4.3	

DAILY AND MONTHLY MEAN TEMPERATURE FOR AUGUST, 1894.

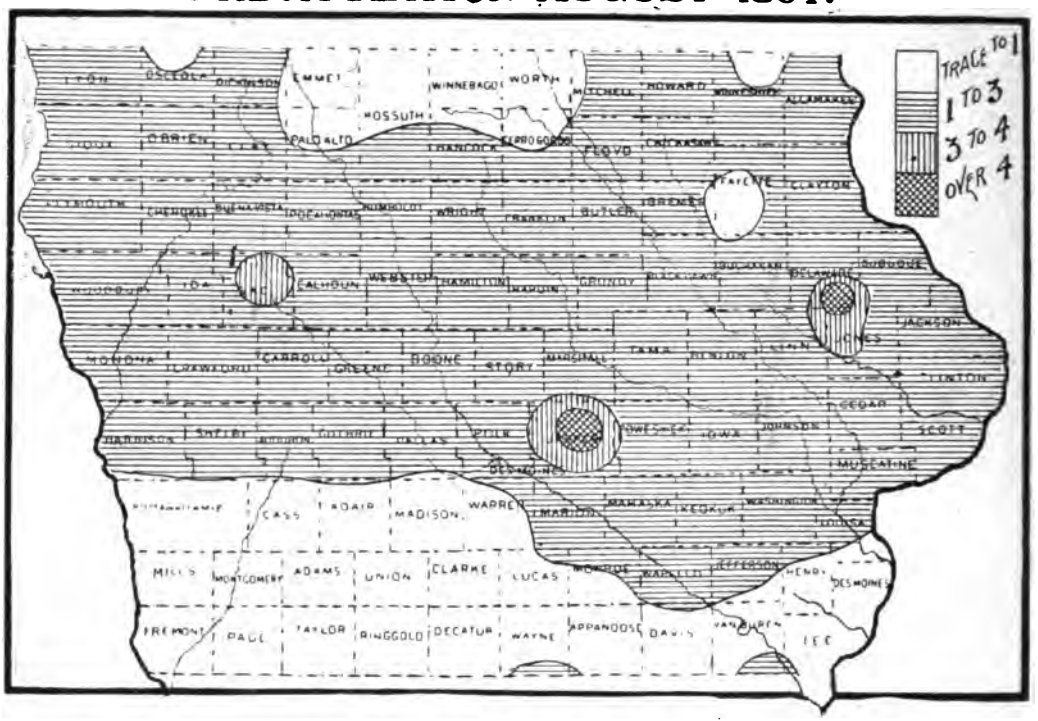
STATIONS.	DATE. 1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	31st.	Monthly Mean.
Afton	80	70	64	68	70	74	79	80	86	88	84	78	84	82	75	80	80	76	77	74	74	78	81	78	70	72	73	76	81	78	80	77.3
Albia	81	73	62	75	69	71	78	79	86	83	83	77	81	81	73	76	82	77	76	64	72	77	79	75	76	68	71	76	78	76	78	75.7
Algona	73	62	62	70	70	80	82	84	80	80	79	73	73	72	69	74	74	70	68	74	74	76	76	73	68	68	72	76	69	65	74	72.9
Alta	78	64	64	68	71	78	82	82	83	84	78	76	73	74	68	72	77	73	71	73	73	74	78	72	70	71	72	76	72	71	76	74.1
Amana	80	68	61	64	69	74	82	82	85	82	78	76	69	76	73	72	79	73	70	70	73	73	76	75	73	68	68	72	74	70	70	73.5
Ames															72	76	79	70	70	71	72	76	76	75	74	68	69	77	76	68	71	73.0
Atlantic	78	65	62	62	66	74	79	81	82	86	86	76	78	77	70	76	76	71	76	74	72	76	78	78	72	68	68	72	80	75	78	74.5
Audubon	78	65	62	62	66	74	78	79	83	86	84	76	76	76	71	73	78	76	78	72	68	75	79	76	74	70	69	74	78	74	78	74.4
Belle Plaine	82	68	60	66	72	72	82	81	86	82	79	76	70	76	72	72	80	73	72	70	74	75	78	77	74	70	70	74	78	74	71	74.4
Bonaparte	82	74	67	68	71	74	78	81	87	86	84	80	78	82	78	78	81	79	74	72	75	77	79	76	78	72	72	74	80	76	78	77.1
Carroll	70	67	62	60	70	76	80	83	85	82	81	78	71	71	69	67	67	72	71	70	72	74	78	71	68	67	68	78	73	68	74	72.3
Cedar Falls	79	76	68	66	69	75	82	83	84	81	81	76	73	74	78	74	80	74	74	74	74	78	74	70	73	73	74	76	74	69	70	75.6
Cedar Rapids	82	70	64	63	69	74	82	84	88	83	78	81	72	76	74	72	78	74	76	76	72	74	75	77	74	68	68	73	76	72	70	74.7
Centerville	78	72	70	70	71	78	84	81	93	85	84	83	84	84	76	79	78	82	80	80	82	78	77	79	80	81	79	80	74	75	79	79.0
Charles City	81	69	69	67	75	77	82	86	82	73	78	74	76	80	75	74	81	83	72	74	74	78	78	76	75	74	76	73	74	66	69	75.2
Clarinda	80	70	63	66	76	75	78	79	84	87	87	85	86	81	74	80	82	82	79	74	74	75	78	78	76	75	70	74	78	78	79	77.6
Clinton	80	74	66	63	66	70	78	81	83	78	76	78	73	78	74	72	74	76	71	72	72	72	74	78	74	72	68	72	74	72	68	73.6
College Springs	80	73	64	62	71	75	78	80	83	88	90	84	86	82	74	81	80	77	78	76	74	72	81	77	75	75	74	76	82	82	81	77.8
Corning	78	72	62	64	68	74	76	78	83	86	83	76	81	80	72	78	80	76	74	71	74	76	73	75	74	68	72	79	77	76	74	74.9
Cresco	79	61	60	63	70	77	82	83	77	68	78	72	74	73	66	70	78	72	70	74	70	74	80	76	72	68	72	76	70	65	66	72.0
Davenport	82	72	62	68	72	74	80	81	85	78	76	80	72	78	74	73	74	78	74	70	72	78	75	75	78	71	70	74	78	72	73	74.6
Decorah	82	64	58	64	68	80	84	85	80	76	77	73	73	75	67	70	76	72	69	74	72	70	78	79	74	68	70	70	72	63	66	72.8
Delaware	79	60	60	67	69	75	81	83	78	70	74	73	68	74	68	70	74	72	68	70	68	70	73	76	71	65	66	70	69	64	65	70.7
Des Moines	82	68	64	65	70	75	82	82	86	84	82	80	74	76	72	78	82	76	74	74	73	76	78	77	75	73	70	76	80	74	78	76.6
Dubuque	84	74	61	64	73	75	83	86	80	72	77	75	75	77	73	72	74	75	72	74	70	73	77	79	74	69	71	77	75	67	69	74.2
Elkader	82	65	59	66	68	76	82	84	79	74	80	75	74	77	70	74	78	72	71	71	72	71	77	77	74	66	71	75	72	66	66	73.0
Emmetsburg	72	64	65	66	72	78	84	82	78	76	77	72	70	73	68	71	80	71	62	72	76	75	78	71	68	68	76	74	69	69	73	72.6
Fayette	80	69	58	65	68	76	84	84	80	75	80	74	74	76	73	76	79	72	70	72	72	72	78	78	74	66	71	72	72	66	68	73.5
Forest City	78	68	62	61	66	75	76	82	80	77	77	76	74	75	70	69	75	70	70	67	75	74	78	76	72	69	72	73	76	67	69	72.6
Ft. Madison	81	73	69	75	76	80	83	82	90	84	83	80	78	84	80	78	79	76	75	72	81	80	77	74	79	74	74	74	83	78	79	78.4
Glenwood	84	72	70	69	71	84	84	84	88	92	89	81	87	82	77	84	84	78	89	78	76	78	86	84	77	76	72	78	86	84	82	80.8
Grand Meadow	77	64	60	66	74	76	84	84	77	71	74	72	71	74	70	73	75	70	70	68	74	78	76	72	65	72	73	68	66	69	72	72.1
Greenfield	82	73	65	67	71	75	80	81	88	85	88	80	78	79	73	78	82	74	78	75	75	80	82	79	75	73	73	78	80	81	77	78	77.6
Grundy Center	73	58	60	67	72	76	82	84	82	80	75	72	74	74	71	70	76	73	72	72	75	76	76	76	68	68	72	74	70	68	74	73.0
Hampton	79	64	62	65	68	76	82	84	81	79	78	72	74	74	67	72	76	72	72	71	72	75	78	74	72	66	72	74	70	66	68	72.8
Hopeville	89	72	63	66	69	74	78	80	86	88	84	78	82	82	74	79	82	76	75	73	73	77	80	76	75	74	72	76	82	78	79	77.0
Hopkinton	81	70	62	65	70	74	82	85	84	76	76	76	74	75	72	72	74	74	71	72	71	72	76	76	70	66	70	73	74	68	68	73.0
Independence	78	66	60	64	68	73	78	82	84	78	79	74	74	76	70	72	77	72	70	69	70	72	76	74	70	68	70	72	71	68	68	72.2
Indianola	82	72	61	68	65	72	81	82	86	85	83	80	78	78	73	78	82	75	74		72	74	80	80	75	71	76	70	80		77	76.5
Iowa City	78	72	60	62	68	70	77	78	84	78	77	76	75	75	74	70	75	72	70	68	70	71	72	72	68	67	70	72	70	69	71	71.9
Iowa Falls	76	69	60	62	63	76	80		79	78	78	71	70	75	69	73	75	72	71	72	74	71	78	78	75	66	68	70	72	70	71	72	0
Jefferson	81	73	63	65	72	74	82	83	87	88	86	82	77	78	74	74	79	76	72	74	74	78	80	78	75	72	71	80	79	75	74	76	6
Keokuk	83	75	65	66	70	74	78	82	87	88	82	80	79	83	78	76	78	80	75	71	74	76	77	71	76	73	72	74	80	80	78	77	0
Keosauqua	82	75	65	63	71	75	78	81	88	86	82	80	78	81	78	76	80	78	72	72	74	76	77	76	76	72	70	73	80	76	76	76	4
Knoxville	77	71	64	66	70	74	78	78	84	82	79	77	75	77	74	76	84	74	74	70	74	78	82	76	77	73	74	76	82	74	80	75	8
La Crosse, Wis	77	62	59	66	70	78	80	85	75	71	74	74	72	76	66	68	78	72	70	75	70	71	76	79	74	68	74	76	70	65	68	72	0
Logan	80	68	67	68	68	80	82	82	86	90	88	72	64	70	72	79	74	74	79	71	74	73	79		76	72	74	78	80	80	79	75	2
Marshalltown		62	62	66	74	78	83	84	86	84	78	76	70	74	72	76	76	74	72	71	72	77	76	76	69	68	71	72	76	70	74	73	9
Mason City	78	63	57	64	63	76	80	82	77	76	78	70	76	74	72																	
Maxon	79	72	66	70	74	79	84	85	90	86	86	76	76	82	73	80	82	77	74	67	74	77	80	76	77	73	71	78	82	76	80	75	5
Mechanicsville	80	69	62	70	68	70	76	82	85	77	76	77	72	76	73	72	74	74	70	70	69	71	74	73	74	67	69	75	78	71	68	72	6
Monticello	82	68	60	62	69	74	80	84	84	78	77	75	74	76	73	72	73	72	74	74	71	72	76	76	70	68	70	72	71	69	68	73	0
Mt. Pleasant	82	67	62	63	68	70	76	82	84	76	78	77	74	78	74	74	77	73	71	74	70	72	74	73	76	71	67	68	76	69	71	72	4
Newton	82	70	65	67	72	74	73	84	88	82	79	77	71	76	75	76	80	74	72	72	73	75	76	75	76	71	70	74	76	75	73	75	2
Ogden	87	71	64	75	71	78	86	88	86	88	83	78	72	78	71	76	78	77	72	74	76	78	78	76	74	74	78	78	80	74	76	77	1
Omaha (Neb.)	80	70	64	68	72	78	81	82	84	88	85	76	84	78	74	78	82	77	8	76	75	78	81	76	75	74	74	78	80	80	82	78	0
Osage	74	62	59	62	68	75	77	80	76	68	74	67	69	71	64	69	73	67	68	72	68	70	74	72	66	63	66	70	66	61	65	68	9
Oskaloosa	80	69	62	65	68	74	80	83	86	80	77	78	73	78	73	76	81	75	70	73	76	74	76	76	74	71	68	71	76	72	73	74	5
Ottumwa	82	72	64	67	69	75	80	83	88	83	81	78	78	80	75	76	84	78	73	70	72	76	78	76	72	70	74	81	73	77	76	2
Ovid	82	74	66	68	70	74	80	82	88	88	85	84	84	86	78	79	84	81	76	73	74	78	79	77	80	75	78	78	82	80	80	78	8
Panama	78	66	62	66	70	76	80	80	83	85	84	74	78	74	71	73	77	73	72	74	73	76	76	74	73	70	71	76	80	77	80	74	8
Richland	78	68	66	66	68	69	79	84	89	85	75	75	74	77	72	76	80	74	72	70	69	75	78	76	71	70	64	76	78	76	76	74	3
Sac City	72	72	70	68	71	78	86	86	87	84	80	80	75	76	73	78	78	78	70	69	74	78	82	76	73	71	74	76	74	76	78	75	9
Seymour	78	76	62	68	72	75	78	82	86	86	84	82	81	82	76	79	84	79	78	70	72	78	80	75	74	73	78	78	80	80	80	77	5
Sibley	72	62	60	64		72	76	79	78	79	75	73	72	70	66	70	75	70	75	72	72		74	74	66	66	70	74	73	68	74	71	4
Sioux City	77	64	62	65	73	80	82	84	82	75	78	72	70	74	78	73	76	73	74	78	82	73	72	70	72	78	76	72	78	76	72	78	5
Spirit Lake	71	65	60	72	78	80	84	80	78	84	78	81	70	72	75	72	82	71	68	76	75	77	82	74	70	72	80	79	70	71	75	75	0
Sutherland	74	63	62	65	72	79	79	83	82	83	77	74	71	70	68	72	77	68	70	74	73	74	77	72	69	70	73	74	69	70	74	72	9
Vinton	80	67	62	69	72	76	82	84	87	79	76	74	72	77	70	75	77	73	63	70	71	73	77	76	72	66	70	74	72	69	68	73	4
Washington	80	72	62	66	70	74	78	80	86	80	77	76	71	78	74	72	78	75	73	72	72	74	76	75	74	70	70	74	78	72	72	74	2
Webster City	78	62	62	68	72	74	81	87	85	81	82	79	70	74	75	75	78	76	68	74	73	77	76	75	73	72	73	75	74	70	75	74	7
Williams	73	62	62	70	72	74	81	81	82	80	71	74	69	69	66	74	77	71	65	72	74	76	78	75	72	68	73	73	69	68	72	72	3
Winterset	83	70	64	68	70	76	82	82	86	85	83	76	77	78	72	76	82	75	75	72	73	75	82	78	75	72	71	76	82	74	77	76	3

MAXIMUM AND MINIMUM TEMPERATURE FOR AUGUST, 1894.

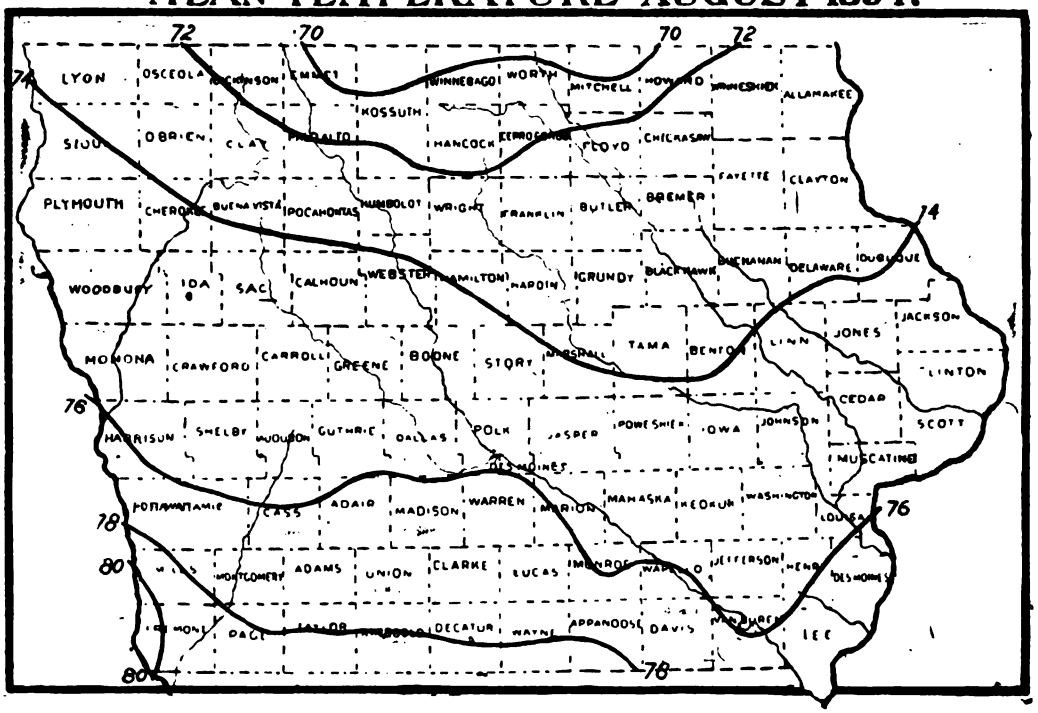
| STATIONS. | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | | 9 | | 10 | | 11 | | 12 | | 13 | | 14 | | 15 | | 16 | | 17 | | 18 | | 19 | | 20 | | 21 | | 22 | | 23 | | 24 | | 25 | | 26 | | 27 | | 28 | | 29 | | 30 | | 31 | | Mon'y Mean. | |
|---|---|---

STATIONS.	DATE. 1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th	27th.	28th.	29th.	30th.	31st.	Total.
Afton	....	..	....	....	..	....	....	....	....	....	0.05	....	....	....	....	....	....	....	....	....	....	0.07	....	....	....	....	....	....	....	....	....	....	0.12
Albia	....	....	....	....	....	....	....	....	....	0.02	T	T	0.03	....	....	....	T	....	T	0.45	....	....	T	....	T	....	....	....	....	....	....	0.50
Algona	....	....	....	....	....	....	....	....	....	1.10	....	.14	.30	....	....	....	....	....	0.23	....	....	....	....	....	....	....	....	....	....	....	....	1.77
Alta	....	....	....	....	....	T	....	....	....	....	1.02	....	....	1.12	....	.02	.40	T	....	0.10	0.21	..	....	....	....	....	....	....	....	....	....	2.87
Amana	....	....	....	....	....	....	....	....	....	....	.53	....	0.13	1.31	....	....	....	....	....	0.01	....	....	....	....	....	....	....	....	....	....	....	1.98
Ames	....	....	....	....	....	....	....	....	....	0.57	....	1.02	....	....	T	....	0.02	....	0.49	....	....	....	....	....	....	....	....	....	....	....	....	2.10
Atlantic	....	....	....	....	....	....	....	....	....	....	....	T	0.41	0 10	....	....	....	....	....	0.05	....	....	....	....	....	....	....	....	....	....	....	0.56
Audubon	....	....	....	....	....	....	....	....	....	....	....	0.15	0.25	0.90	....	0.01	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1.31
Belle Plaine	....	....	....	....	....	....	....	....	....	....	0.52	....	0.23	0.45	..	....	....	....	0.14	....	....	....	....	T	....	....	....	....	....	....	....	1.34
Bonaparte	....	....	....	....	....	....	....	....	....	....	0.10	....	0.34	..	....	....	0.08	....	....	0.26	....	....	....	....	0.38	....	....	....	....	....	....	1.60
Carroll	....	....	....	....	....	....	....	....	....	....	0.23	T	....	....	0.80	0.08	....	....	0.28	....	....	0.20	....	....	0.02	....	....	....	....	....	....	1.61
Cedar Falls	....	....	....	....	....	....	....	....	....	....	0.10	0.10	1.75	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1.95
Cedar Rapids	0.03	....	....	....	....	....	....	....	....	....	0.37	0.03	....	1.68	....	....	0.35	....	....	....	....	....	....	....	0.02	0.03	....	....	....	....	....	2.51
Centerville	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.65	....	....	....	....	....	....	....	....	....	....	....	....	0.65
Charles City	....	....	....	T	....	....	....	....	....	0.18	0.09	....	0.03	0.65	....	....	....	....	....	....	....	....	0.15	....	....	....	....	....	....	....	....	....	1.10
Clarinda	0.09	....	....	....	....	....	....	....	....	....	T	....	....	0.02	....	....	....	....	....	0.05	....	....	....	....	0.07	....	....	....	....	....	....	....	0.23
College Springs	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	T	....	....	....	T	....	....	....	....	....	....	....	T
Corning	....	....	....	....	....	....	....	....	....	T	....	0.14	T	....	....	....	....	....	T	0.23	....	....	T	....	....	....	....	....	....	....	....	....	0.37
Cresco	....	....	....	....	....	T	....	....	....	0.60	0.05	....	0.30	....	....	....	....	....	....	0.08	....	....	....	....	....	....	....	....	....	....	....	....	1.03
Davenport	T	....	....	....	....	....	....	....	....	T	0.46	....	T	0.66	....	....	0.90	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2.02
Decorah	....	....	....	....	....	....	....	....	0.49	0.04	....	....	T	....	....	....	....	....	....	T	....	....	....	....	....	....	....	....	....	....	....	....	0.53
Delaware	....	....	....	....	....	....	....	....	....	....	0.08	....	0.77	....	....	....	0.90	....	....	....	....	....	....	....	....	0.02	....	....	....	....	....	....	1.77
Des Moines	....	....	....	....	....	....	....	....	....	T	0.65	T	0.56	0.26	T	....	T	....	T	0.42	....	....	....	....	T	....	....	....	....	....	....	....	1.89
Dubuque	....	....	....	....	....	....	....	....	....	0.30	....	....	T	0.68	0	0	0.34	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1.32
Elkader	....	....	....	....	....	....	....	....	....	0.54	....	....	1.15	....	....	....	0.15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1.84
Emmetsburg	....	....	....	....	....	....	....	....	....	....	0.96	....	0.27	0.27	....	....	....	....	0.36	0.17	....	....	....	....	....	....	....	....	....	....	....	....	2.09
Fayette	....	....	....	....	....	....	....	....	....	0.45	0.04	....	0.20	0.93	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1.44
Forest City	....	....	....	....	....	....	....	....	....	0.58	....	....	0.21	....	....	....	....	....	....	....	....	....	0.08	....	....	....	....	....	....	....	....	....	0.87
Fort Madison	0.12	....	....	....	....	....	....	....	....	T	0.12	....	0 09	....	....	....	0.06	....	0.11	....	....	....	....	0.05	T	....	....	....	....	....	....	....	0.55
Glenwood	0.02	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.02
Grand Meadow	....	....	....	....	....	T	....	....	....	0.55	T	....	....	0.45	....	....	0.03	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1.02
Greenfield	T	....	....	....	....	....	....	....	....	0 05	0.25	0.05	0.08	T	T	T	T	T	T	0.09	....	....	0.01	T	....	....	....	....	....	....	....	....	0.53
Grundy Center	....	....	....	....	....	....	....	....	....	0.64	....	....	1.27	....	....	....	....	....	0.10	....	....	....	....	....	....	....	....	....	....	....	....	....	1.71
Hampton	....	....	....	....	....	....	....	....	....	0.88	....	0.20	1.49	....	....	....	....	....	0.06	....	....	0.05	T	....	....	....	....	....	....	....	....	....	2 68
Hawkeye	....	....	....	....	....	....	....	....	....	0.21	T	....	....	....	....	0.62	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.83
Hopeville	....	....	....	....	....	....	....	....	....	0.13	....	0.03	T	....	....	....	0.46	..	T	0.07	....	....	0.06	..	....	....	....	....	....	....	....	....	0.75
Hopkinton	....	....	....	....	....	....	....	....	....	0.06	....	1.40	....	....	....	1.70	....	....	....	....	....	....	....	....	....	1.10	....	....	....	....	....	....	4.24
Humboldt	....	....	....	....	....	....	....	....	....	0.29	....	0.27	0.69	....	0.01	....	....	....	0.20	0.11	....	....	....	....	....	....	....	....	....	....	....	....	1.57
Independence	....	....	....	....	....	....	....	....	....	....	0.20	....	....	1.90	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2.10
Indianola	....	....	....	....	....	....	....	....	....	0.80	T	T	0.15	T	....	....	T	....	T	....	....	....	....	....	....	....	....	....	....	....	....	....	0.95
Iowa City	....	....	....	....	....	....	....	....	....	....	0.90	....	0.12	1.34	T	....	0.04	....	T	....	....	....	....	....	....	....	....	....	....	....	....	....	2.40
Iowa Falls	....	....	....	....	....	....	....	....	....	....	....	0.45	....	0.22	0.62	....	....	....	....	0.17	....	....	....	....	0.10	....	....	....	....	....	....	....	1.56
Jefferson	....	....	....	....	....	....	....	....	....	....	0.65	....	1.10	0.22	....	0.15	....	....	....	0 26	....	....	....	....	....	....	....	....	....	....	....	....	2.58
Keokuk	0.10	....	....	....	....	....	....	....	....	T	0.01	....	T	0.09	....	....	....	....	T	0.25	....	....	....	T	0.06	....	....	....	....	....	....	....	0.51
Keosauqua	....	....	....	....	....	....	....	....	....	....	....	....	0.04	0.11	....	....	....	T	T	0.26	....	....	....	....	0.58	....	....	....	....	....	....	....	0.99
Knoxville	....	....	....	....	....	....	....	....	....	0.70	T	....	0.20	....	....	....	T	....	T	0.52	....	....	1.20	....	....	....	....	....	....	....	....	....	2.62
Logan	....	....	....	....	....	....	....	....	....	....	0.11	0.37	1.11	....	....	0.13	....	....	0.02	0.09	....	....	....	....	....	....	....	....	....	....	....	....	1.83
Le Claire	0.05	..	....	....	....	....	....	....	....	....	0.30	0.04	....	0.84	....	....	0.34	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1.57
Marshalltown	....	....	....	....	....	....	....	....	....	0.52	....	....	0.59	....	....	....	T	....	0.03	....	....	....	....	....	....	....	....	....	....	....	....	....	1.20
Mason City	....	....	....	....	....	....	....	....	....	0.10	0.20	....	0.06	0.60	....	....	....	....	....	....	....	....	0.02	....	....	....	....	....	....	....	....	....	0.98
Maxon	....	....	....	....	....	....	....	....	....	T	....	0.10	....	....	....	....	....	....	....	0.43	....	....	0.17	....	....	....	....	....	....	....	....	....	0.60
Mechanicsville	....	....	....	....	....	....	....	....	....	....	0.40	....	0 03	1.25	....	....	0.73	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2 41
Monticello	....	....	....	....	....	....	....	....	....	....	0.57	....	0.03	0.27	....	....	1.46	....	....	....	....	....	....	....	....	0 09	....	....	....	....	....	....	3.42
Mt. Pleasant	....	....	....	....	....	....	....	....	....	....	0.31	....	0.18	0.06	....	....	0.06	....	0.02	....	....	....	....	....	....	0.03	....	....	....	....	....	....	0.66
Newton	....	....	....	....	....	....	....	....	....	....	2.00	....	2.10	0.10	....	....	T	....	0.01	0.32	....	....	....	....	....	....	....	....	....	....	....	....	4.53
North McGregor	....	....	....	....	....	....	....	....	....	0.52	0.03	0.02	....	0.27	....	....	0.48	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1.32
Ogden	....	....	....	....	....	....	....	....	....	....	0.29	....	1.24	0.19	....	0.04	....	....	0.01	0.51	....	....	....	T	....	....	....	....	....	....	....	....	2.28
Omaha, Neb	....	....	....	....	....	....	....	....	....	....	....	0.25	0.01	0.03	....	0.07	....	....	T	T	....	....	....	T	....	....	....	....	....	....	....	....	0.36
Osage	....	....	....	....	....	T	....	....	....	0.22	0.60	....	1.36	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2.18
Oskaloosa	....	....	....	....	....	....	....	....	....	....	1.05	....	0.95	0.05	....	....	....	....	....	0.25	....	....	....	....	....	....	....	....	....	....	....	....	2.30
Ottumwa	T	....	....	....	....	....	....	....	....	....	0.60	0.22	0.16	....	....	....	T	....	T	0.28	....	....	....	....	....	0.06	....	....	....	....	....	....	1.32
Ovid	..	....	....	....	....	....	....	....	....	....	0.18	0.02	T	....	....	....	....	....	....	0.15	....	....	....	....	....	....	....	....	....	....	....	....	0.35
Panama	....	....	....	....	....	....	....	....	....	....	....	0.16	0.10	0.98	0.39	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1.63
Richland	....	....	....	....	....	....	....	....	....	....	1.63	....	0.30	0.04	....	0.16	....	....	....	0.05	....	....	....	....	....	0.04	....	....	....	....	....	....	2.22
Rockwell City	....	....	....	....	....	....	....	....	....	T	0.25	....	0.88	....	T	0.22	....	....	0.10	0.30	....	....	....	....	....	....	....	....	....	....	....	....	1.75
Rock Rapids	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Sac City	....	....	....	....	....	....	....	....	....	0.35	....	....	0.50	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Seymour	....	....	....	....	....	....	....	....	....	0.18	T	0.33	0.23	....	....	....	....	....	....	0.28	....	....	0.31	....	0.26	....	....	....	....	....	....	....	1.59
Sibley	....	....	....	....	....	....	....	....	....	T	....	....	0.26	0.18	0.12	....	....	....	0.28	0.13	..	....	....	....	....	....	....	....	....	....	....	....	0.97
Sioux City	....	....	....	....	....	....	....	....	....	0.07	0.02	T	0.55	T	0.02	0.45	....	....	0.08	0.49	....	....	....	....	....	....	....	....	....	....	....	....	1.68
Spirit Lake	....	....	....	....	....	....	....	....	....	0.21	0.08	....	0.60	....	....	....	....	....	0.05	....	....	....	....	....	....	....	....	....	....	....	....	....	1.11
Sutherland	....	....	....	....	....	....	....	0.01	0.13	0.67	..	0.30	1.16	....	0.38	....	....	0.07	0.14	....	....	0.04	....	....	....	....	....	....	....	....	....	....	2.90
Villisca	....	....	....	....	....	....	....	....	....	....	0.31	....	....	....	....	....	....	....	....	0.08	....	....	....	T	....	....	....	....	....	....	....	....	0.39
Vinton	....	....	....	....	....	....	....	....	....	....	0.31	T	1.14	....	....	0.83	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2.28
Washington	T	....	....	....	....	....	....	....	....	....	1.22	0 14	0.22	0.28	....	T	0.30	....	T	....	....	....	....	....	....	....	....	....	....	....	....	....	1.89
Webster City	....	....	....	....	....	....	....	....	....	....	0.80	....	....	0.85	T	....	....	....	....	0.30	....	....	....	....	....	....	....	....	....	....	....	....	1.95
Williams	....	....	....	....	....	....	....	....	....	....	0.58	....	0.31	0.39	....	....	....	....	0.36	....	....	....	....	T	....	0.05	....	....	....	....	....	....	1.69
Winterset	....	....	....	....	....	....	....	....	....	0.14	0.17	T	0.08	0.03	....	....	T	....	T	0.11	....	....	....	....	....	....	....	....	....	....	....	....	0.53

PRECIPITATION AUGUST 1894.



MEAN TEMPERATURE AUGUST 1894.



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From the following, weekly and monthly reports of Meteorological data are received by the Iowa Weather and Crop Service.

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Albia (Maxon)	Gus Johnson.
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Alta	D. E. Hadden.
Amana	Conrad Schadt.
Ames (Exp. Station)	W. H. Heileman.
Atlantic	J. W. Love.
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Belle Plaine	H. W. Vandike.
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Centerville	Prof. H. E. Reister.
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Clarinda	A. S. Van Sandt.
Clinton	Luke Roberts.
College Springs	A. A. Berry.
Corning	John W. Bixby.
Cresco	Gregory Marshall.
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Osage	G. D. Pattingill.
Oskaloosa	Jos. Boyd.
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Postville	F. L. Williams.
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Sibley	H. G. Doolittle.
Sidney	G. V. Swearingen.
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Sutherland	W. H. Bloom.
Tipton	J. M. Rider.
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Villisca	J. F. McCartney.
Washington	Wm. A. Cook.
Waukee	John Wragg
Webster City	C. M. Trumbauer.
Winterset	Will McKnight.
West Bend	Phil. Dorweiler.
Williams	M. L. Fuller.

*U. S. Weather Bureau.

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Winterset	H. A. Kinsman.
Wall Lake	I. E. Wilcox.
Walnut	F. L. Martin.
What Cheer	O. D. Lawrence.

Met. 217

UNITED STATES DEPARTMENT OF AGRICULTURE
WEATHER BUREAU.

MONTHLY REVIEW

OF THE

Iowa Weather and Crop Service.

VOL. V. —SEPTEMBER, 1894.—NO. 9.

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CENTRAL STATION, DES MOINES, IOWA.

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DIRECTOR.

GEO. M. CHAPPEL, M. D.,
LOCAL FORECAST OFFICIAL,
U. S. WEATHER BUREAU, ASS'T DIRECTOR.

DES MOINES:
G. H. RAGSDALE, STATE PRINTER.
1894.

THE IOWA WEATHER AND CROP SERVICE

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U. S. Department of Agriculture---Weather Bureau.

MONTHLY REVIEW

OF THE

IOWA WEATHER AND CROP SERVICE.

VOL. V.] SEPTEMBER, 1894. [No. 9.

EDITORIAL NOTES.

In an average season the milk, butter and cheese produced in Iowa are worth over $40,000,000.

***

Mr. A. Lufkin, of Newton, sends a correction of an item in the August REVIEW, wherein it is stated that an inch of rainfall on an acre yields 22.623 gallons of water, and on a square mile 324,612,902 gallons. According to Mr. Lufkin's figuring the amounts should be 27,154 gallons per acre, and 17,378,560 gallons per square mile.

The item was clipped from a column of "Scientific Notes" in an exchange, and was copied without attempt at verification. The error was in the number of gallons on a square mile, which was much too high. The number of gallons per acre is correct according to the standard used by the writer of the Scientific Notes, who evidently was a foreigner. The *imperial* gallon, which is the standard British gallon for both dry and liquid articles, contains ten pounds avoirdupois weight of distilled water, weighed in air at 62 degrees F., the barometer at 30 inches. It contains 277.274 cubic inches. Using that standard an inch of rainfall would yield exactly 22,622.53 gallons of water, and a square mile would yield 14,478,419.20 gallons. The United States standard unit of liquid measure is the old English or Winchester wine gallon of 231 cubic inches, which contains 8.33888 pounds avoirdupois of distilled water at its maximum density, that is, at the temperature of 39.83 degrees F., the barometer being at 30 inches. According to that standard an inch of rainfall on an acre amounts to 27,154.29 gallons. On a square mile the amount is 17,378,745.60 gallons.

***

Chas. A. Schaffter, editor of the Eagle Grove *Gazette* and one of the efficient observers of this service, died at his home in Eagle Grove, September 18th, aged 57 years. He was a worthy citizen, faithful in all the relations of life, and his departure is a serious loss to the community and to the State.

***

An interesting experiment was made September 5th by Prof. Assman at Berlin for the purpose of ascertaining the temperature and pressure of air in atmospheric altitudes above the greatest height explored by man. For this purpose a balloon was constructed and supplied with automatic registering instruments. The balloon was liberated at Charlottenburg and soon rose out of sight, and came down in Zwornik in Bosnia in eleven hours, the distance being more than 1,000 kilometers—about 620 miles. The barometer indicated that the balloon rose to the height of 53,546 feet—over ten miles—and the temperature fell to 62° below zero.

***

Some writer has said: "The thermometer that will rise the highest in summer and fall the lowest in winter is a joy forever." That expresses it. People like to excel their neighbors in getting the tallest heat, the severest cold, the biggest hailstones, and the most terrific "cyclone." There is a tendency to exaggerate all extremes of weather.

***

Wiggins, the alleged weather prognosticator, has advanced the suggestion that telegraph and telephone wires cause drouths. His theory is that thunder-clouds will give down rain while they are kept insulated, but they dry up when the electricity is drawn off by the wires. The theory is very much like Wiggins' prognostications—pure bosh.

***

The drouth was very severe in Michigan despite the fact that it is nearly surrounded by lakes, and has extensive forests and a vast water surface. The last crop report, dated September 1st, issued by the Secretary of State, says: "One year ago the drouth prevailing was referred to as being without a parallel. There had been no general rain after the 22d of June and light showers had afforded only temporary relief. But that drouth, severe though it was, was light compared with the one prevailing September 1st of this year. In July and August of this year an average of less than two inches of rain fell in the State, as compared with nearly four inches in the same months in 1893. The average rainfall in August this year was 0.49 of an inch."

***

At the third annual meeting of the American Association of State Weather Services, held at Brooklyn, N. Y.,

August 17, 1894, the following named officers were elected for the ensuing year: Major H. H. C. Dunwoody, president; Captain T. F. Townsend (Pa.), 1st vice-president; Mr. S. W. Glenn (S. Dak.), 2nd vice-president; Mr. James Berry, secretary and treasurer; Mr. J. Warren Smith (New England), Mr. E. W. McGann (N. J.) and Dr. C. P. Cronk (Md.), executive committee.

Although the number of state weather services represented at the meeting was somewhat smaller than on previous occasions, the convention was well attended and in every way a success.

***

It is a noteworthy fact that during the prevalence of the hot winds of July 25th, 26th and 27th, the temperature in Texas and Oklahoma averaged lower than in Iowa, Kansas and Nebraska. This indicates that our scorching winds were mainly home products, resulting from the clear, dry atmosphere, bright sunshine and powerful radiation of heat from our vast stretches of browned pastures.

The July *Bulletin* of the Texas Weather Service says: "Hot winds prevailed on the first three days of July generally throughout the state. A striking feature of these winds was that they came from the north, a direction which ordinarily would bring cool weather. It is believed these high temperatures were of dynamic origin."

***

Prof. James Wilson says: "We never had as high an opinion of Iowa soil as we have now after seeing what it will do in a drouth when it is well handled. The experience of 1894 will deter no good farmer from planting again but it will set everybody to thinking. Preparation of the seed bed will in the future be better, cultivation will be continuous in dry weather, and it will be suited in depth to the character of the soil. Plants will be preferred that are deep rooting, and for the dry months continuous green feed will be arranged for by wise men. Draining will be pushed wherever the ground remains wet too long in spring so as to avoid radiation by cracking open when it dries. Every method practical will be resorted to to conserve the moisture in the soil, and to that end the pastures will get more study than they have had, and late sown oats and barley will be abandoned."

***

H H. Fitch, editor of the farm department of the *Sac Sun*, says: "Fields that were worked late are better than those laid by early, other conditions being equal. Corn planted deep, four inches, withstood the drouth better under similar conditions than corn planted more shallow. Corn worked shallow the last two cultivations, and so leaving the surface of the ground nearly level, has given the best results, other things being equal. Corn planted on ground descending to the north, and northeast, has fared best this season."

***

Water boils when the pressure of its vapor produced by heating just exceeds the pressure of the external atmosphere. Thus the temperature at which boiling takes place depends on the atmospheric pressure, and, as is well known, is lower on the top of a mountain than at its base; so that cooking operations become more difficult at a high-lying place, such as Quito on the Andes. Also from this cause the temperature of boiling water is less when the barometer is low. Thus we see that while the melting point of ice is lowered by pressure, the point of vaporization of water is raised by increasing the pressure. The law is that when a substance contracts on changing its state, as ice does on becoming water, the temperature at which the change occurs is lowered by pressure; when the change of state is accompanied by expansion, as when the water becomes steam, the effect of pressure is to raise the temperature at which the change takes place. An interesting and readily performed experiment on the effect of pressure on the boiling point is the following: Boil some water in a flask; while boiling is going on, cork the flask and remove the source of heat; when the glass vessel has somewhat cooled down, squeeze a sponge saturated with cold water over the flask, and boiling will be seen to recommence. This is owing to the fact that the sudden application of the cold water outside condenses the vapor about the hot water within, and thus considerably reduces the pressure above it, so that bubbles of vapor can be again formed in the liquid and boiling is renewed.—*J. J. Stewart in Knowledge.*

***

The theory that sloughs or ponds will prevent drouth does not stand investigation. Alike in the lake region of northern Iowa and southern Minnesota, along the Mississippi, in the vicinity of the great lakes and about the most extensive tracts of marsh or swamp land in the upper Mississippi and Ohio valleys the drouth has been as marked as on the best drained upland prairie. The truth is that rains come on the oceanic winds from the Gulf of Mexico and those winds drop their moisture early in their northern journey or hold it late just as the atmosphere into which they pass is colder or warmer. Man can do nothing to change those conditions by draining land or making lakes or ponds. His puny efforts sink into insignificance. The grand causes which govern are wholly beyond human power, and while science cannot yet penetrate the causes of the fluctuations between drouth and flood there is good reason to think that such an extreme as this year is not likely to occur again in several generations. There seems to be a law of periodicity not known in its nature, but on which faith can be safely placed that extreme dryness will not be more frequent hereafter than in the past.—*Marshall Times-Republican.*

***

Prof. Atwater urges reform in stockfeeding. He says beef that has less fat would yield more nutrition for the money, and more strength for the man. We should feed cattle which are destined for beef a ration which will cause a rapid growth of the muscular parts, and at the same time furnish enough carbonaceous material to put on a moderate amount of fat. For this purpose wheat furnishes the best food, and when it is cheaper than corn it should be fed to stock.

***

The newspapers have recently given accounts of the sudden caving in of the surface in Butler, Sedgwick and Marion counties, Kansas. Numerous sink holes have been

formed ranging from 28 to 350 feet in depth. Prof. Haworth, of the Kansas University, thinks caverns have been washed out in the chalk beds, or soft limestone of that region, and to that fact he attributes the sudden sinking of the surface in various localities.

***

Prof. Jas. Wilson says: "We would prefer bran, weight for weight, to either wheat or wheat flour. Iowa farmers should buy whatever is cheapest that will balance our corn fodder. and corn is least likely to do it; while bran if it can be had at wheat prices is about the most profitable by-product we can buy."

***

The Nevada *Representative* says: "Anthony Picht has about thirty acres of corn on low tiled ground that will go from forty to sixty bushels to the acre." There are abundant testimonials to establish beyond doubt the value of tile-drainage both for wet and dry seasons.

***

There has been a deficiency in seasonal rainfall over a wide extent of country. The last *Bulletin* issued by the U. S. Weather Bureau gives the following summary: "The seasonal rainfall, from March 1st to October 1st, has been decidedly less than the average over much the greater part of the country. Iowa and the eastern portions of South Dakota and Nebraska comprise the region where the total rainfall of the season just closed formed the least percentage of the usual amount, only about 50 per cent of the average rainfall occurring in the region named.

"From the central Mississippi valley eastward to the middle Atlantic coast the actual rainfall amounted to about three-fourths of the seasonal average. Eastern Tennessee, southwestern Virginia, southern Maryland and southern New England, however, received but little more than half the average, while portions of the Ohio valley and middle Atlantic coast had from 75 to 90 per cent of the average seasonal amount.

"In Florida and portions of Georgia, Texas, Arkansas, western Tennessee, eastern Kansas, Colorado, upper Michigan, eastern Montana and on the north Pacific coast more than the average rainfall occurred.

"A decided deficiency in rainfall exists over the greater part of California."

***

Mr. Fernow says forests serve three purposes—"the purpose of beauty, the purpose of regulating water-flow and soil conditions and the purpose of supplying material." To this it may be added, forests break the force of heavy winds, thereby preventing too rapid evaporation and mitigating the severity of storms. Iowa would be vastly richer and more productive if fully one-fifth of its area were covered by dense forest belts. We could produce greater crops on the four-fifths than we do now upon the whole acreage, and the remaining fifth devoted to forestry would yield adequate returns in form of fuel and timber.

The article on "Conservation of Moisture in the Soil," by Prof. Samuel B. Green, contains some valuable matter for Iowa People. It is timely and suggestive.

A TROPICAL CYCLONE.

A tropical hurricane, or cyclone, of great breadth and unusual severity, was noted in the West India Islands September 23d. It came from the southeast, sweeping the full length of Cuba as with a besom of destruction, and after reaching the south extremity of Florida its course was turned to the north and northeast, passing along the coast to a point above Hatteras, thence into the Atlantic. The cyclone raged over forty-eight hours on the Island of Cuba, resulting in great destruction of property. It is reported from Havana that the village of Dagua, 120 miles east of that place, was demolished and two hundred lives were lost. No lives are known to have been lost in the Atlantic States, but the damage to property was very heavy, especially in Florida. The width of the disturbance was over one thousand miles. The U. S. Weather Bureau gave warning of its approach, and by timely display of signals in advance, hundreds of vessels were detained in the harbors. The saving of property amounts to millions of dollars. The effects of the storm were noted as far north as Boston, and the rainfall at various points on the coast was excessive.

If a cyclone of that character should sweep through the west, the resultant destruction of property would exceed the damage caused by a dozen storms like the one which wrought desolation in some of the northern counties of Iowa on the evening of September 21st. A tornado exerts much greater force than a cyclone, or tropical hurricane, but its violence is expended in a few moments, and its pathway rarely exceeds a few hundred feet. The cyclone above referred to occupied five days in its passage from Cuba to Hatteras, and it blew great guns all the time, day and night, attaining at times a velocity of eighty-eight to one hundred miles an hour.

RAIN-MAKING—TILE DRAINAGE—FORESTRY.

FORKST CITY, IOWA, October 3, 1894.

J. R. Sage, Director Iowa Weather and Crop Service, Des Moines, Iowa:

DEAR SIR—I want to express to you my appreciation of the MONTHLY REVIEW, which I receive regularly and read with much interest and profit. I like your sound views, as I regard them, on some of the meteorological problems that in these days are turning the heads of a good many people.

For instance, rain-making. According to the gospel of some folks, if God did "create the heavens and the earth" it was done a little before they were born and they can improve upon His plan of watering it at least. But they are not all agreed on the method. One man says he can shoot some vile-smelling stuff into the upper air and forthwith the clouds will form as they did in Elijah's time. And it is strange how many people will believe this fakir. But so far as I have heard it is mostly town people who put their money into it. Perhaps they get tired waiting for customers and are willing to resort to anything for a change. If they really have any faith in it, it can hardly be said to be an unselfish act for the benefit of the farmer. But let us hope that the occupation

of the "professor of rain-making" is gone. It needs something more than chemicals and a crank to make the skies weep when they have no tears to shed.

But there's another class of philosophers who are much exercised over the amount of tile draining done in this country. "That's what's the matter with the weather nowadays! Plug up or take up all your tile. Let the sloughs fill up as of yore. Bring back the ague and malaria, the muskrats and mosquitoes, and give us the slough water for our calves, the "seepage" for our wells, the local evaporation for showers to water our farms. Then we'll be happy and not lack for water."

But these same philosophers fail to remember that some of the dryest years ever known in Iowa were before there was probably a mile of tile laid. They forget, too, that all the water in all the lakes, all the rivers and all the sloughs in the State in its palmiest days of wetness would not be sufficient to give this commonwealth an inch of rainfall. Where the other twenty-five or thirty inches needed comes from, if answered, will give the correct theory of the source of supply.

Another class, and I speak of it with great reverence, for I am thoroughly in sympathy with their work, if not with all their theories, is the enthusiastic advocate of tree planting. I have heard some men talk who were so sanguine that they believed tree planting had already increased the rainfall not only in Iowa, but in Kansas and Nebraska. If that were true, then why the drouth in 1894? There are undoubtedly more acres of trees growing in the states named to-day than ever before. Only the test of actual experience for a long number of years, will convince me that the planting of a few isolated patches of trees can possibly have any material effect on the amount of water precipitated. I can readily see how it helps to conserve that which does fall. The soft mold in the timber drinks in the rain as it falls. On the prairie or in hard, sun-dried pastures it runs off almost like water from a duck's back. The evaporation in the woods is less than on the prairie, and consequently the spring sources will be more constant and plentiful. All praise to him who plants trees. He will have his reward, not by increased rainfall, but in many other ways which will occur to every intelligent man who in hope and faith clothes the landscape with God's own lovely garments.

But I started out to say that your MONTHLY REVIEW ought to have a larger circulation. It ought to go to more than one or two men in a township. I believe it is sowing the good seed of scientific truth, but not enough of it. If the appropriation at your disposal is insufficient it ought to be increased.

May the good work of disseminating sound meteorological science go forward.

Very truly yours, EUGENE SECOR.

On the southern slopes of the Himalaya mountains, at an altitude of 4,500 feet, 610 inches of rainfall have been recorded in a single year, of which amount 147 inches fell in June.

CONSERVATION OF MOISTURE IN THE SOIL

The following paper, by Prof. Samuel B. Green, horticulturist of the Minnesota Experiment Station, published in Bulletin No. 32 of the series issued from that station, contains matters of special interest to Iowa horticulturists and farmers:

The dry weather of the past season has brought this subject before the agriculturist as never before and all growers of crops have become impressed with its importance. The question of irrigation would be an important one for us if there was any large portion of the State that was situated so as to permit of artificial application of water. There are favored sections where artesian or other water may be used for irrigation to advantage, but generally the planter must depend on the annual rainfall. The importance then of husbanding this water is evident.

The water which reaches the soil is dissipated (1) by running off the surface of the land into the streams; (2) by percolating through the surface soil to the underground water system; (3) by evaporating from the surface of the land. The loss of water by transpiration through the leaves of growing crops is necessary to success, over it we have no control and it is therefore not discussed here.

(1). The loss of water from its running off into streams is quite serious on hillsides and where the land is impermeable. The methods of preventing this are numerous and must be modified according to the crops grown on the land, and its contour. Where practicable, as for instance, where the land is devoted to small fruits, surface washing may largely be controlled by covering the surface of the land with some kind of mulch which by impeding the flow of the water allows it to soak into the ground. The necessity for this in the case of clayey hillsides is evident. There the surface of the soil when exposed becomes so hardened that the rain falling in summer penetrates the land to so slight a depth that it is all evaporated after a very few hours of sunshine, perhaps leaving the land harder and more impermeable than before.

(2). The loss of water by its passing through the soil to the underground water system may be considerable, but over this factor we have little control. The water holding capacity of soil varies very much and success depends largely on the proper selection of soils for different crops. This quality may often be increased by the addition of organic matter to the soil. In some parts of Europe even the prunings of grape vines and willow twigs are often used to mix with the land to increase its humus, but the plowing in of the green crops and the use of stable manures are probably the most practical means for improving the water holding capacity of the soil in this section.

(3). The loss of water by evaporation from the surface of the land must be regarded the prime factor in the dissipation of the water in the soil. This may be lessened (*a*) by wind-breaks, (*b*) by mulching the surface of the soil. and (*c*) by cultivation of the surface soil. This latter method of prevention is not discussed here.

WIND-BREAKS.

It is necessary to allow a circulation of air among cultivated crops in order to prevent serious losses from fungus diseases. Where the air is very much confined and circulates but slowly, as in fields closely shut in by wind-breaks, there is liable to be serious losses from rusts, blights, mildews and the many diseases to which plants are subject, but nevertheless we can secure sufficient circulation of the atmosphere to get its beneficial action in preventing diseases and yet avoid the greatly increased rate of evaporation due to its very rapid circulation. How much the rate of evaporation is increased by exposure to the winds was clearly shown by experiments of Professor T. Russell, Jr., of the Signal Service, in 1887. The result of these experiments show that with the temperature of the air at 84° and a relative humidity of 50 per cent evaporation with the wind blowing at five miles an hour was 2.2 times greater than in the calm; at ten miles 3.8; at fifteen miles 4.9; at twenty miles 5.7; at twenty-five miles 6.1, and at thirty miles per hour the wind would evaporate 6.8 times as much water as a calm atmosphere of the same temperature and humidity. Now if it is considered that the winds which sweep our prairies average a velocity of ten or more miles per hour, and not infrequently thirty miles per hour, the losses which may be prevented by the judicious use of wind-breaks can to some extent be appreciated. Then, too, it is probable that the excessive dryness of some of the winds which occasionally sweep over the prairies is not considered in the above figures, nor is the loss considered which would come from excessive transpiration from the foliage due to this cause, and which is, very likely, no inconsiderable item. It will be understood from these facts that the wind is an important factor in the dissipation of the water from soil and that its injurious action may be prevented to a considerable extent by the judicious use of wind-breaks.

MULCHING.

Evaporation from the surface of the soil may be largely prevented by the use of mulch, and to some extent by the cultivation of the surface of the land. The use of a mulch is quite generally accepted as being desirable around trees, shrubs and small fruit plants, but its exact value is seldom expressed in figures. At the University Farm, the past season, the value of a mulch was clearly shown in many cases. In one case a strawberry bed, growing on open, clayey loam, which was heavily mulched with oat straw, produced a fine crop of strawberries, while strawberry beds in the immediate vicinity, not so treated, were nearly or quite a failure. In fact, this crop was generally a failure in eastern Minnesota the past season, with rare exceptions. The success at the University Farm could not be ascribed to the use of any particular variety, since all the well known kinds were productive. It would seem to be due partially to high cultivation, but chiefly to the use between the rows of a heavy mulch, which had become very compact from being under the snows all winter. Some analyses made by Prof. Snyder, the Station chemist, gave the results set forth in the following table, in which the term mulched bed is used to signify the rows of the strawberries which at the time of the trial were covered with about three inches of broken compacted oat straw; cultivated soil means the land in an adjoining row which was kept stirred by a horse cultivator. Uncultivated soil refers to parts of the strawberry beds where the plants had failed, and consequently no cultivation whatever was given the land, neither was it mulched. The data under the heads of cultivated and uncultivated land was probably much influenced by the proximity of the mulched rows, which undoubtedly greatly increased the amount of water which they contained, so that the results of the table are much modified by it and do not appear as evident as they would otherwise. Great care was taken in selecting the samples to have them from soil of similar appearance, and the soil of the whole bed was very uniform:

TABLE 1.—WATER IN MULCHED, TILED AND UNCULTIVATED SOIL.

DATE.		Depth of sample.	Mulched beds Per cent water.	Cultivated soil. Per cent water.	Uncultivated soil. Per cent water.
June 29	Sub-soil	4 inches.	24.30	19.2	18.01
June 29	Sub-soil		25.93	19.93	20.01
June 30	Surface-soil		20.63	15.48	....
June 30	Sub-soil		21.07	16.20	....

From this table it will be seen that the use of a mulch on the surface soil increased the amount of water it held about five per cent as compared with soil which was cultivated. Calling the weight of a cubic foot of dry soil seventy pounds, which is approximately correct, it will be seen that the use of a mulch resulted in making each cubic foot of the surface soil retain about three and one-half pints of water more than it otherwise would. This is equivalent to increasing the amount of water in the upper one foot of surface soil of one acre by 605 barrels. Of course these figures are only approximate and there are many possible sources of error, yet it would seem that enough was shown to demonstrate that the use of a mulch might easily make the difference between success and failure in maturing a crop of this nature.

Physicists estimate that in order to be in the best condition for the roots of the uncultivated plants to act, the soil should contain from one-third to one-half the weight of water it would contain if saturated. In this case it was found that soil when saturated would hold 55 per cent of water, and as the mulched land contained about 24 per cent it was in excellent condition for root action, even in a period of severe drouth.

USE OF A MULCH ON A GRAVELLY KNOLL.

At the University Farm is a vineyard located on a very dry, gravelly knoll. The vines on this part suffered severely about five years ago from drouth. The following season they were heavily mulched with stable litter and trash of various sorts such as is common about most farms, and it has been kept mulched since that time. This mulch had rotted a good deal and consequently added considerable organic matter to the soil. As the result of

this treatment, the vines recovered and have since yielded good crops of fruit, and even in the past very dry season gave a very bountiful harvest, not being seriously affected by the dry weather. On July 25th tests were made for moisture in the soil under the mulch in the dryer part of this vineyard and as a result the top soil was found to contain 18.3 per cent of moisture and the subsoil 21 per cent of moisture. There was no land close by with which to compare this but on the same date the soil in an oat field at the station, which was apparently and without doubt much better adapted to holding water than that in the vineyard, contained but 3.8 per cent of moisture, an amount so small that plants would probably be powerless to take up any water from it. This would indicate an increase of 14.5 per cent of water which is equivalent to an increase of about ten barrels in the upper foot of each square rod, or 1,600 barrels per acre due to the use of mulch on the soil, and this conclusion seemed to be borne out by the appearance of the vines. It is my opinion that without the mulch the fruit would have all dropped from the vines in the vineyard. On August 4th the top-soil in the vineyard contained 16.3 per cent and the subsoil 17.5 per cent of water, thus showing that while it had lost some water it still contained a sufficient amount of water to enable the roots to work satisfactorily.

MULCHED BLACKBERRIES ON NORTH SLOPE.

In the following table is shown the amount of soil moisture under a heavy mulch on several dates during the most severe portions of the drouth of the past summer. The land where these observations were made is on the north slope of a hill. The east end of it is a little heavy, while the west is loose and gravelly. The land was used for growing blackberries and the mulch consisted of six inches of old hay put on in the spring.

TABLE II.—SHOWING WATER IN SOIL UNDER A HEAVY MULCH ON NORTH SLOPE.

July 22..	A. M.	East end	Top-soil.	24.1 per ct.	.....	.....
July 22..	A. M.	East end	Sub-soil.	23.9 per ct.	.....	.....
July 22..	P. M.	East end	Top-soil.	22.1 per ct.	.....	.....
July 22..	P. M.	East end	Sub-soil.	19.1 per ct.	.....	.....
July 25..	A. M.	East end	Top-soil.	23.6 per ct.	West end.	21.9 per ct.
July 25..	A. M.	East end	Sub-soil.	20.5 per ct.	West end.	23.5 per ct.
July 25..	P. M.	East end	Top-soil.	20.7 per ct.	West end.	15.5 per ct.
July 25..	P. M.	East end	Sub-soil.	20.2 per ct.	West end.	19.5 per ct.
Aug. 4...	A. M.	East end	Top-soil.	17.5 per ct.	West end.	16.4 per ct.
Aug. 4...	A. M.	East end	Sub-soil.	18.2 per ct.	West end.	17.3 per ct.

On July 27th the soil in the oat field where the land would compare favorably with the west end of the plat referred to in the preceding table, except in the matter of exposure, contained only 4.2 per cent of water, an amount so small as to be unavailable to the roots of plants.

It will be noticed from the above table that in the thirteen days intervening between July 22d and Aug. 4th, there was a loss of seven per cent of water, yet the soil still contained 17.5 per cent, an amount sufficient to enable the roots to work to advantage.

On July 22d the soil in a plat of raspberries, which was near to and on land having about the same properties as that referred to in Table I, on which the strawberries were grown, was tested for its water content. The rows were seven feet apart and mulched to a distance of two and one-half feet on each side. The trials of water were made under the mulch, and in the strip of soil two feet wide between the mulch of adjoining rows, and where the constantly cultivated soil would probably be much influenced by the proximity of the mulched land near it. The next table shows the result of these trials.

TABLE III.—SHOWING THE PER CENT OF WATER IN CULTIVATED AND MULCHED LAND IN ADJOINING ROWS

DATE.		MULCHED.	CULTIVATED SOIL.
July 27....	Top-soil.....	17.6 per cent..	12.5 per cent.
July 27.....	Sub-soil.....	19.3 per cent....	14.5 per cent.

On the same day the soil in the oat field somewhat more sandy than the above contained 3 per cent of moisture.

It will be seen from the table that even in the case of plats in close proximity, where they must influence one another, there is a considerable difference between cultivated and mulched land in favor of the latter. This difference would undoubtedly be much larger than is shown by the table if the plats treated had been isolated from one another.

SUMMARY.

(1). The water-holding and consequently drouth-resisting qualities of the soil are increased by the addition of organic matter to the soil.

(2). The loss of water by evaporation from the surface of the soil must be regarded as the prime factor in robbing the soil of its moisture.

(3). Anything that breaks the force of the wind may make the difference between success and failure in growing crops by lessening the evaporation.

(4). Evaporation from the soil may be largely prevented by the use of a mulch on the surface.

(5). The use of a mulch may sometimes increase the amount of water in the upper one foot of soil on one acre by 1,700 barrels, and it probably exerts as much influence on the several upper feet of soil. As the roots of corn and most other vigorous plants penetrate several feet into the soil the increase due to a covering of mulch must be considerable.

(6). Using the figures given in the preceding pages it will be found that a circular plat of land six feet in diameter that is mulched may have the water it contains increased in a period of drouth by eight gallons in the upper two feet of soil. This indicates the great value of a mulch around street trees.

(7). The use of a mulch on many garden crops will often make the difference between success and failure.

RAINFALL, FORESTS AND POPULATION.

The census shows an interesting relation between rainfall and population. Three-fourths of the people of the United States dwell in regions where the annual precipitation is from thirty to forty inches. The greatest density of population, leaving out the large cities, is where from forty to fifty inches of rain fall in the year.

The increase in population has been most rapid where the annual rainfall is between twenty and thirty inches. but allowance must be made for the fact these figures have to do with territory newly opened to settlers through

the building of railways, and the advancing of the borderline of civilization. Density of population diminishes rapidly where the annual rainfall is considerably less or more than from twenty to fifty inches.

The foreign figures, of course, do not hold good in regions where the most of the year's rain comes in the form of phenomenal cloud-burst following periods of drouth.

A government bulletin is devoted to the question whether the destruction of forests reduces rainfall. The research was exhaustive, taking in the results of observations scientifically made in various countries. It appears that, while clearing off the wooded areas affects but slightly the total annual rainfall, forests are invaluable conservators of it. They act as reservoirs of moisture, which they distribute to adjacent fields in rivulets of dew.

Taken together, these census figures and these bulletin facts are a valuable lesson on the importance of scientific forestry to this country.—*Youth's Companion.*

CORN FODDER.

SIOUX CITY JOURNAL: The drought this year has not been without a valuable lesson in those localities of the corn country which suffered most severely. It has taught the value of the corn plant, apart from the grain, as feed for live stock and the importance of more economical methods in saving and using it. The region along the Missouri river is so good a grass country that farmers have permitted a large part of the corn plant to go wholly or extensively to waste. The failure of grass has forced farmers to resort to corn for feed, and they thus find an immense resource which indeed they in a way knew of before but did not utilize. Unnumbered thousands of acres of corn which will produce only a few bushels of grain will yet bear unnumbered tons of feed for live stock. Never before have the farmers in this part of the northwest made so extensive use as they have this fall of the stock and leaves and other parts of the corn plant. It really means a new departure. Just as the grasshopper scourge in northwestern Iowa twenty years ago was the occasion which, to their incalculable profit, turned farmers from growing wheat to growing corn, and then to its conversion into beef and pork, so this season's drouth will result in utilization of the wealth of the hitherto wasted parts the corn plant—parts which in the aggregate are hardly less valuable than the grain itself. Important as are the immediate results this year, they are only a beginning, only a suggestion of the results that will be realized in the future. There is hardly a particle of the corn plant above the roots that will not thus be used. Labor saving machinery for cutting and processes for saving the plant now bring this resource within the reach of every enterprising and sagacious farmer. In a word, so far as cattle, horses, sheep and similar live stock are concerned, the distinctive corn country may be virtually independent of the hay crop—a fact which, as anyone who understands the situation comprehensively will see, is of tremendous practical import. The present outlook is some suggestion of this advantage. In the grass country, outside the corn region, farmers are forced by lack of feed to sacrifice their cattle. The general stock of the country will almost certainly be reduced, and that portion which can be carried over to next season must be concentrated in the corn country. The prospect, of course, is that there will be at least fair prices for cattle and hogs next year, but only those who have corn fodder will get the full benefit of the probable market. It will tide farmers over a season when both grass and grain fail, and it is a resource in any year.

FORESTRY IN THE PRAIRIE STATES.

The writer has long been convinced of the importance of giving more attention to the subject of forestry in the prairie states. It is a sad fact that our forest states are not sufficiently protected by forest laws; prairie states have even less protection. The state of Iowa gives a little encouragement to grow forest trees. The laws in general allow certain exemptions, but the beautifying of grounds and planting with forest trees has had the opposite effect, higher taxation. General forest protection is needed in the great lumber states, and even in the state of Iowa. The loss of lumber and timber in Minnesota and Wisconsin during the past season emphasizes the importance of more work along these lines. Europe has long recognized the importance of forestry, not only because of the money value in timber for building, etc., but because of the climatic and other influences in modifying surrounding features of a country. Forestry stations and schools have been established everywhere.

What of the United States? Scarcely any laws to protect timber, no schools where forestry is taught exclusively, and but few schools where forestry is taught.

Aside from the Iowa laws referred to above no encouragement to forestry is given. The state and local horticultural societies have in times past done much work to stimulate the planting of forest trees. A strong, healthy sentiment is growing up among the school children of the state, but we need more than this. School children can do much in the way of encouragement.

In 1892 there were planted on various school grounds in the state of Iowa something like 750,000 trees. Many of these have no doubt not grown for want of proper care.

Let us look at forest conditions of Iowa. The state has within its domain 2,523,782 acres of timber land. Roughly speaking, nearly ninety-nine per cent of the state is capable of cultivation, and nearly all of this, some of the most fertile and productive land in the Mississippi valley. The original forest area occupied between 3,000,000 and 4,000,000 acres, although it is hard to get figures. The census of 1870 put it at 2,524,193 acres for that year. Considerable of this timber has been removed, and the work of destruction is constantly going on. This destruction will not stop till an educated public will see the importance of more forest areas.

I cannot overlook the fact that in all our cities and villages shade and ornamental trees in great numbers have been planted. While these are of importance, they cannot entirely replace forest conditions.

The state of Iowa contains the following rivers, with considerable forest areas: On the west, the Missouri; on the east, the Mississippi; in the interior, Iowa, Des Moines, Cedar, Maquoketa, Sioux, Maple, Skunk, Turkey, and many smaller streams. These were in early times all skirted with timber, the timbered area varying in width from one-half to four and five miles, the best belts of timber occurring along the Mississippi, where in places it reaches nearly thirty miles from the river, though in most cases it is considerable less.

Iowa does not lack in indigenous species. Many of the northern species, like the Shell Bark Hickory (*Carya alba*), Red Oak (*Quercus rubra*), Black Oak (*Quercus coccinea*), White Oak (*Quercus alba*), Swamp Oak (*Quercus bicolor*), Green Ash (*Fraxinus viridis*), Hard Maple (*Acer barbatum*), Soft Maple (*Acer saccharinum*), Box Elder (*Acer negundo*), Bass Wood (*Tilia americana*), White Elm (*Ulmus americana*), and Red Elm (*Ulmus fulva*), but we have a great many southern species in the southern part of the state, and in some cases these extend well up along our rivers The Kentucky Coffee Tree (*Gymnocladus dioicus*), Honey Locust (*Gleditschia triacanthos*), Swamp White Oak (*Quercus bicolor*), Pin Oak (*Quercus palustris*), Laurel Leaved Oak (*Quercus imbricaria*), Chestnut Oak (*Quercus Muhlenbergii*), Red Bud (*Cercis canadensis*), Ohio Buckeye (*Aesculus glabra*), Mocker Hickory Nut (*Carya sulcata*), and *Carya tomentosa* occurring in the state.

Many exotic trees do admirably in Iowa. Of the conifers I need only mention *Picea excelsa*, *Pinus austriaca*, *Pinus sylvestris*, *Larix europaea*. Of our western and northern conifers, the *Pinus ponderosa*, *Pseudosuga douglasii*, *Picea nigra*, *Picea alba*, *Abies balsamea*, *Abies fraseri*, *Abies concolor*, *Larix americana*, *Picea pungens*, *Pinus banksiana*, *Pinus resinosa*, and *Tsug canadensis* do admirably in many parts of Iowa, most of the species over the entire state.

We have only two, or possibly three conifers native in Iowa. *Pinus strobus*, *Juniperus virginiana*, and possibly *Abies balsamea*, according to Mr. Wragg, occurs near McGregor. The White Pine as a cultivated tree is common everywhere in Iowa. Very few of the conifers in this state and only in a few places have they been tested under forest conditions.

Aside from the economic value of timber, the more important consideration of protection to soil and climate should be considered, the utility of using forest trees in long rotation and improving the soil.

We should remember that nothing injures a forest more than pasture conditions. The writer has seen the effects of this not only in Iowa, but in Wisconsin and Missouri. It prevents the formation of leaf mould, so important for the forest tree.

L. H. PAMMEL.

Iowa Agricultural College, Ames.

Mr. Peter Youngers, Jr., of Geneva, Neb., reports highly gratifying results of experiments in subsoil plowing, both in the nursery grounds and in the production of grain and vegetables.

A DESTRUCTIVE STORM.

On the evening of September 21, between the hours of 7 and 11, a heavy storm passed through the counties of Clay, Palo Alto, Kossuth, Hancock, Winnebago, Cerro Gordo, Worth, Mitchell and Howard, and continued with diminished energy across Winneshiek county and thence into Wisconsin. An off-shoot or part of the same storm crossed the line and wrought heavy damage in the southeastern counties of Minnesota. The newspaper and other accounts of the storm indicate that the destruction of life and property was caused by a group of thunder and hail storms, accompanied by heavy wind squalls, carrying in their wake two or three small but vigorous tornadoes which struck the earth at numerous points along the line of the disturbance. The distance traversed, on a nearly direct course east by north, was over two hundred miles. A diagram of the storm belt would show it in fan-shaped form, varying from a few thousand feet at its point of inception to about twenty-five miles in width at its eastern extremity.

A local paragraph in the Le Mars *Sentinel* states that the first appearance of the storm was near that place, at about 5 P. M. Two mighty currents of air met, it is stated, and a funnel was formed, which left a narrow trail through the corn fields, passing to the northeast within two miles of Le Mars. The storm evidently did not assume a very destructive form until it reached Lincoln and Riverton townships, in Clay county, in which region the complete destruction of buildings began.

From this point in Clay county the Iowa Mutual Tornado Insurance Company reports total losses of buildings in every county and in nearly every township on a nearly direct line to Cresco, Howard county. President Miles Bradford of that company, who has recently traveled over a large part of the storm's pathway in Iowa, adjusting the losses sustained by his association, gives a vivid description of the desolation wrought, and his report leaves no doubt that the bulk of the work of destruction was caused by tornadic movements of the wind at various points along the line. The main track of the storm is shown by dark lines across the temperature chart on the last page of this issue.

Fortunately there was no large town directly in the pathway of this destructive storm; but it passed close to the thriving cities of Emmetsburg, Algona, Osage and Cresco, and swept through the little hamlets of Cylinder, Hayfield and Lowther.

The first reports of the losses of life and property were somewhat exaggerated, but it has been ascertained that fifty-three persons were killed outright, or died within a day or two after the storm, and some others were very seriously wounded. The loss of property fell most heavily upon the farmers, and it is impossible to make an approximately correct estimate of the aggregate amount.

W. S. Nicholson, of Willow Creek, Clay county, residing near the track of the storm, at its inception, writes as follows: "At 7 o'clock, P. M., September 21, a heavy storm passed across the county, from west to east by north, which developed a path of squalls, blowing down

some trees, small buildings and haystacks. The Swedish Lutheran church in Lincoln township was entirely demolished. The storm seemed to become more severe as it moved eastward." Several farm houses were destroyed, but no lives were lost in Clay county.

Entering Palo Alto county the storm swooped down and wrought some damage on the divide in the southwest corner of Highland township, then passed lightly over the valley of the Des Moines river, coming down again with destructive force about a mile south of Emmetsburg. Mr. J. H. Carmichael, voluntary observer at Emmetsburg, writes as follows:

During the afternoon the atmosphere seemed heavy and oppressive, the thermometer indicating a temperature of 76 to 78°. The prevailing wind direction was southeast, sky cloudy. The storm was first noticed about 5:50 P. M. in southwest, with nothing unusual in its appearance. The clouds were of a greenish black hue, moving toward the northeast. Thunder was first heard about 6:15 P. M. At this time another storm was observed in the northwest, moving toward the southeast. Blinding flashes of lightning and violent thunder accompanied both storms. So vivid were the flashes and so intense the darkness between them that it was almost impossible to observe the action of the storm clouds.

As nearly as I can ascertain the two storms came together about eighteen to twenty miles west of Emmetsburg. Rain began to fall here about 6:40 P. M., gently at first and with light winds. Thunder and lightning became more violent. The rain ceased about 7:20, thunder and lightning continuing. Suddenly there was a blinding flash of lightning followed by a tempest of hailstones, varying from a walnut to a hen's egg in size. This was accompanied by light winds from both north and east, as shown by broken panes of glass on both sides of houses. The hailstorm continued for about three minutes, and was followed by a brief calm. At 7:30 the tornado struck the fair grounds one-half mile south of the center of the town, and almost exactly in the geographical center of the county, demolishing the buildings, stables, fences, etc., carrying the buildings and fences on the north part of the grounds to the northeast and those of the south and southeast parts to the southeast, while singularly, the west fence was carried to the west. The cemeteries adjoining the fair grounds on the south were swept, and many of the monuments were overturned, mostly to the east. Across the road east of the cemeteries the house and farm buildings of Mr. Foley were wrecked and carried to the northeast; 1,500 bushels of threshed oats were carried entirely away. The family had a storm cave close to the house, but were unable to use it, as the usual roar which accompanies tornadoes was not heard, and five members of the family were injured, without loss of life, however. Parties living in and near to the track of the storm claim to have seen from one to three funnel shaped clouds; these appeared to some of them to have been of a whitish color. A Mr. Peters, living three miles east of Mr. Foley, and almost in the center of the track of the storm, claims to have distinctly seen three of the death dealing monsters; one was to the north and another to the south of him, and had passed to the east of his place, moving in a zigzag course; the third one coming from the west was almost upon him when he discovered it; he had barely time to drop into his cyclone cellar when it passed over, demolishing his house and outbuildings, carrying the debris to the east. The Gallegher brothers places, a short distance to the northwest of Mr. Peters, were visited, and the barns, sheds and granaries destroyed, and the fragments carried to the northeast. The trees growing in front of their places on both sides of the road were uprooted, and some of them twisted off and blown to the north. Neither of the houses were damaged to any extent. Hundreds of hay stacks in the path of the storm had the appearance of having the tops twisted off and carried away; others seemed to have been turned bottom side up. A steel wind-mill, belonging to Mr. Myers, was badly twisted and bent toward the west.

The Golden residence, where three of the family were killed, and the barn and sheds of Mr. Cullen, situated about forty rods to the east, were carried to the southeast, while property damaged near the little town of Cylinder, about a mile to the southeast, was carried in an easterly direction. The storm covered a space of about two miles in width. Fortunately, however, it passed through a strip of territory not very thickly settled. In traveling a distance of five miles eastward the storm moved one mile to the north. As near as can be estimated the onward movement of the storm was about thirty miles per hour. The north and middle appendages appear to have done the most damage in this county. A mile on either side very little was felt of this terrible monster, and very few people living in this city realized until the next day how near it came to being another Pomeroy disaster. The only wind that was particularly noticeable in the town was a sudden gust from the north lasting but a moment or two, and supposed to be about the time the fair grounds were struck. The storm, with its almost incessant thunder and lightning, quickly passed to the east. Seven miles east of this place the storm seems to have disappeared, only to reappear about six miles further on in Kossuth county.

No rain following the storm; precipitation, .62; temperature after storm, 61°.

The width of the storm track (two miles) through Palo Alto county, indicates that there were three tornado funnels, which moved on nearly parallel lines for some distance, and then diverged as they moved eastward, assuming gradually the form of a direct wind of hurricane force. One of these triplets passed through Worth, crossing the Cedar river near St. Ansgar, thence in a direct line to LeRoy and other points in Minnesota. The other "twisters" kept on the more direct line of disturbance, passing below Manly Junction, striking with renewed force near Osage, then wiping out the little hamlet of Lowther, causing heavy damage at other points in Howard county.

At the little station of Cylinder, southeast of Emmetsburg, six dwellings and a number of outbuildings were destroyed. It is reported that nine people were killed near Emmetsburg and Cylinder, in Palo Alto county.

Kossuth county seems to have suffered heavy loss of life and property. A local paper gave the names of nineteen dead and six more probably fatally injured, within the limits of that county. The Algona *Upper Des Moines* contains a very full report of the storm, from which the following paragraphs are clipped:

The storm swept across Kossuth county from west to east Friday evening at 8 o'clock, about three and one-half miles north of Algona. It entered the county in Lotts Creek township and going slightly to the north crossed the Black Cat creek to the river, and then carried destruction along Plum creek, passing over the county line a little north of the Wm. Ward farm. It covered a territory about a mile wide, demolishing barns, mills, and stacks. In its path it destroyed everything.

The storm came without warning. The breaking of windows was the first intimation people had of anything to be feared. Some reached their cellars, some were caught at the cellar door. At Algona the wind was from the south. North of the track of the storm the wind was from the north. From both directions it sucked the air into its vortex. In places it struck with incredible fury, and in others the escape of buildings and people is almost miraculous. It took a course no one would have believed possible through wooded creek valleys and across the Des Moines. Some report noticing a roaring sound, but those in the path of it say they did not notice it. The lightning was exceedingly brilliant, but the lack of thunder or any roar was so conspicuous as to excite attention in Algona.

The wind performed many curious freaks along its course. At the Kargleder place an iron pump and the iron tubing were taken out of the well, and here also a granary full of wheat was

left untouched. At Barrick's a turkey was stripped of feathers, and over east at Holman's a rooster was trying to crow Saturday morning with his feathers plucked. At Boever's the reporter found a duck which had lain all night with a heavy beam on its head, and which was able to open one eye and quack when it was released. A turkey with both eyes out, and a pig at Jos. Thompson's with a pine stick in its shoulder several inches are reported. At Mr. Schenck's an old granary stood safely right in the path of the wind. At Mr. Rice's an empty wash-tub stood on his water tank in front of the wind-mill. The mill and tower and chicken house were torn out completely, but the tub never moved an inch. The chicken house, a heavy 16x16 foot building, was taken around the end of the hay stack and set in between two red oak trees, where it would have been difficult to pull it with horses, without a window glass being broken, and Saturday morning the hens were sitting on their eggs as unconsciously as though they had not been moved. At Mr. Rice's also the window lights were broken in the east end of his house. Fences were destroyed all along, but at the Boever's place the wire was broken and blown about by the force of the wind.

At W. M. Ferguson's only the remains of a willow hedge testify that the place was ever inhabited. His house was scattered for half a mile through the corn field. His own escape was miraculous. With his wife and baby he was carried twenty rods, part way through the willows over rough ground. When the storm was by he found himself holding his wife, both unhurt, and the baby on a piece of the house roof near by, crying, but also unhurt He gathered all that was left of his fine farm outfit into a wagon box.

West of the Boevers' farm the first place demolished was Fred Pompe's. Everything was destroyed, and Mrs. Pompe, who is a large fleshy woman, and five little girls had a miraculous escape. The house tumbled down about their ears, but the timbers so fell that a little space a few feet in dimensions was left, and in this they were huddled. After they were taken out no one could believe that they had been in so small a space. Mr. Pompe and the other children had been in town to the fair, and had not gone home and so escaped.

The branch of the storm that passed in a northeastern direction wrought some destruction in Winnebago county. The Forest City *Summit* says:

There seems to have been a division of the storm somewhere near Wesley in Kossuth county, from which point one funnel traveled due northeast, while the other took a more easterly direction. The line of the first mentioned crossed the northwest corner of Bingham township, in Hancock county, and continued in a northeasterly direction across Winnebago county and passed into Minnesota at section 10, of Eden township. The other cloud crossed the north end of Hancock county, leaving the county at the line of section 1 in Ellington township.

At the Bilstad farm, one mile west of Amund post office, the Breckey family and others had a most thrilling experience. There were seven persons in the house, which was picked up and carried several rods and then dashed to pieces. There was a fire in the stove at the time and this ignited a portion of the wreck beneath which A. H. Ross and another person were pinioned. Mr. Ross says that a wall of the building lay across his body, but his head and shoulders were free, and in this position he lay and fought the fire with his hands. Both men succeeded in crawling from under the wreck and at once looked after the rest of the folks, all of whom were found to be safe. Mr. Ross had his face pounded up in a dreadful manner by the flying debris, but is thankful in getting off with his life.

In the northern part of the county the damage to grain stacks was very heavy, and for a distance of seven miles south from the state line it is estimated that the total loss of property will aggregate $50,000.

J. M. Elder, Esq., of Concord, wrote as follows: "The destruction and loss of life by the tornado of the evening of the 21st cannot be fully ascertained at this time (Sept. 23). The destruction of property within the storm limits was the most complete I ever saw; in fact complete annihilation. Fortunately the limits were narrow. The time was between 8 and 9 P. M., during which period the electric storm which prevailed, for awful grandeur, was never equalled. The whole heavens were illuminated, disclosing storm centers in every direction, while the thunder was incessant and so terrific that houses were shaken on their foundations as by a distant earthquake. The reports from other counties are sorrowful indeed. The storm was phenomenal in (1) occurring at so late an hour, (2) occurring so late in the season, and (3) in possessing all the characteristics of a true tornado, as distinguished from a straight wind. I visited to-day five farms upon which the buildings are utterly destroyed, and large quantities of stock lying dead about the ruins."

In Cerro Gordo and Worth counties the loss of life and property was comparatively light. Through Mitchell county there were two well defined tracks, showing the destructive effects of tornadoes, which are quite fully described in the following report from Observer G. D. Pattengill, of Osage:

On the night of September 21st, two tornadoes passed over this county, both of which were destructive to farm buildings and crops in their paths. The northern one seemed to be on its way to LeRoy, Minn. From the point where it entered the county (Twp. 99, R. 18), until near the Little Cedar river, it was very destructive. Besides houses, barns, crops, etc., it picked up a large iron bridge over the Cedar river near St. Ansgar, and left it a wreck, bottom up, some four or six rods up the stream. This tornado moved more to the northeast than its mate. The time was between 10:00 and 10:30 P. M.

The other tornado must have passed over the southern part of Osage, and it dropped down and began scattering grain and corn shocks within a mile eastward of the town. After doing slight damage to buildings a mile or two it reached the great barns of Nichols & Cotter, and thence east and but little north, along a road with houses on each side, it left nothing but ruins. It had been raining at intervals after 7:00 P. M., and about 9:30 I noticed much lightning along the west and northwest. At almost exactly 10:00 it began to hail, the wind until this time being southeast. It veered to the south, then west, then northwest. The hail was very large, and much glass was broken. There was a constant play of lightning, but no discharges reached the ground, and no signs of it appeared in the wreckage. Many persons were hurt, and five were killed, all within one-half mile; no others in this county so far as I have heard. This storm was going directly toward the little station of Lowther, in Howard county.

The trees and corn on the north side of track were bent or broken towards the south or southeast, and on south side towards north or northeast. At some points it showed that trees were broken towards the west or northwest as the tornado was approaching, and afterwards other trees and debris were thrown upon them from the opposite direction as the storm passed ahead. This was nicely shown in one grove where a part of the trees fell to the west at the beginning, and over them are laid another lot of trees which fell towards the east and southeast The center of the tornado did not seem to move forward in a direct line, at times east and again northeast. It seems to me, after looking over a portion of its track, that the wind was rushing furiously toward the center from all points of the compass at the same time, and that there was a very rapid current ascending through the center. Some large and heavy objects, like the bodies of a row of willow trees which had been grubbed out, and were from twelve to twenty-four inches through, were lying on the north side of the road, and north of the storm center. Many of these were moved, some carried over a fence and dropped eight or ten rods south, making some large holes in the ground.

The width of the tornado was about forty rods. In Howard county, Lowther station (Acme postoffice), was struck and every building was carried away, but no person was seriously hurt. The buildings on the Howard county fair grounds, near Cresco, were badly wrecked. The storm passed over Cresco, but the tornado had evidently at that point assumed the form of a severe squall, or its force was so far spent that the destruction of property was comparatively light. The Cresco *Plain Dealer* says:

> Had the full violence of the storm struck Cresco the probabilities are that but few houses would have been left standing, and amazing would have been the loss of life. All that saved these people was the elevation of the wind. Perhaps the real battle was two hundred feet high, and the disaster caused here was simply uneasy streaks of the violence endeavoring to deploy into the kingdom below. This can be inferred from the irregularity of the course taken, and the peculiar jumps it made.

The local newspapers of the counties through which the storm passed are filled with details of the storm, sufficient in amount to fill a good-sized volume. All reports and descriptions indicate that it was the most far-reaching and wide-spread wind storm that ever swept over any portion of this fair state.

SEVERE DROUTHS IN THE MIDDLE STATES.

Mr. C. Warren furnishes the following from records giving the length of the most noted dry spells in the middle states:

In the summer of 1634, 24 days.
In the summer of 1642, 41 days.
In the summer of 1687, 74 days.
In the summer of 1662, 80 days.
In the summer of 1664, 45 days.
In the summer of 1688, 81 days.
In the summer of 1694, 92 days.
In the summer of 1705, 30 days.
In the summer of 1715, 46 days.
In the summer of 1728, 61 days.
In the summer of 1730, 92 days.
In the summer of 1741, 72 days.
In the summer of 1745, 72 days.
In the summer of 1764, 108 days.
In the summer of 1755, 24 days.
In the summer of 1763, 133 days.
In the summer of 1773, 80 days.
In the summer of 1791, 82 days.
In the summer of 1812, 28 days.
In the summer of 1856, 26 days.
In the summer of 1871, 42 days.
In the summer of 1875, 26 days.
In the summer of 1876, 26 days.

The longest drouth above mentioned, which occurred in 1763, began on the first day of May, and ma y inhabitants of this country were compelled to send to Europe for grain and hay.

These figures make Iowa's recent drouth—the worst the state ever knew or is likely to know in the future—seem mild in comparison. June 22d there was a fall of rain in Marshall county of 1.25 inches and no more until July 20th, when there was another of a 25th of an inch, making a dry spell of four weeks. So that our unprecedented drouth is a mild one if it is to be compared with any one of dozens on record in the eastern and middle states.—*Marshall Times-Republican.*

It should be noted that the longest period of drouth in the above records occurred over a century ago, at which time but little progress had been made in clearing the vast forests, draining the ponds, tiling the fields, and making that section of the country habitable for civilized man. A careful study of records covering all the years since the early settlement of this country, does not disclose any appreciable decrease or increase in the seasonal precipitation, or in the temperature and humidity of the air. A high state of civilization and cultivation of the soil is entirely compatible with favorable climatic conditions.

NOVEMBER'S PAST WEATHER RECORD.

DES MOINES—SIXTEEN YEARS' RECORD.

TEMPERATURE—Mean or normal, 37°. The warmest November was that of 1878, with an average of 43° The coldest November was that of 1880, with an average of 29°. The highest temperature during any November was 75°, on the 1st, 1888. The lowest temperature during any November was 10° below zero on the 29th, 1891.

PRECIPITATION—Average for the month, 1.80 inches. Average number of days with .01 of an inch or more, 7. The greatest monthly precipitation was 6.49 inches in 1879. The least monthly precipitation was 0.34 inches in 1878. The greatest amount of precipitation recorded in any 24 consecutive hours was 2.58 inches on November 11, 1879. The greatest amount of snow-fall recorded in 24 consecutive hours (record extending to winter of 1884–85 only) was 3.0 inches on November 30, 1886.

CLOUDS AND WEATHER—Average number of clear days, 13. Average number of partly cloudy days, 10. Average number of cloudy days, 7.

WIND—The prevailing winds have been from the northwest. The highest velocity of the wind during any November was 40 miles, from the northwest, on November 19, 1887.

DAVENPORT—TWENTY-THREE YEARS' RECORD.

TEMPERATURE—Mean or normal, 39°. The warmest November was that of 1878, with an average of 42° The coldest November was that of 1880, with an average of 31°. The highest temperature during any November was 78° on the 1st, 1888. The lowest temperature during any November was 10° below zero on the 29th, 1891.

PRECIPITATION—Average for the month, 1.98 inches. Average number of days with .01 of an inch or more, 9 The greatest monthly precipitation was 4.70 inches in 1879. The least monthly precipitation was 0.57 inches in 1875. The greatest amount of precipitation recorded in any 24 consecutive hours was 2.03 inches on the 5th, 1883. The greatest amount of snowfall recorded in 24 consecutive hours (record extending to winter of 1884–5 only) was 4.4 inches on the 27th, 1892.

CLOUDS AND WEATHER—Average number of clear

days, 9. Average number of partly cloudy days, 10. Average number of cloudy days, 11.

WIND—The prevailing winds have been from the northwest. The highest velocity of the wind during any November was 42 miles on the 17th, 1892.

KEOKUK—TWENTY-THREE YEARS' RECORD.

TEMPERATURE—Mean or normal, 39°. The warmest November was that of 1878, with an average of 44°. The coldest November was that of 1880, with an average of 31°. The highest temperature during any November was 79° on the 1st, 1888. The lowest temperature during any November was 30° below zero, on the 29th, 1872.

PRECIPITATION—Average for the month, 1.95 inches. Average number of days with .01 of an inch or more, 8. The greatest monthly precipitation was 3.91 inches in 1879. The least monthly precipitation was 0.74 inches in 1874. The greatest amount of precipitation recorded in any 24 consecutive hours was 1 84 inches on November 11, 1881. The greatest amount of snowfall recorded in 24 consecutive hours (record extending to winter of 1884-5 only) was 4.4 inches on November 11, 1886.

CLOUDS AND WEATHER—Average number of clear days, 8. Average number of partly cloudy days, 11. Average number of cloudy days, 11.

WIND—The prevailing winds have been from the northwest. The highest velocity of the wind during any November was 40 miles, from the east, on November 11th, 1881.

SIOUX CITY—FIVE YEARS' RECORD.

TEMPERATURE—Mean or normal, 34°. The warmest November was that of 1890, with an average of 40°. The coldest November was that of 1891, with an average of 30°. The highest temperature during any November was 74° on the 20, 1890. The lowest temperature during any November was 9° below zero on the 28th, 1891.

PRECIPITATION—Average for the month, .82 inches. Average number of days with .01 of an inch or more, 6. The greatest monthly precipitation was 1.99 inches in 1889. The least monthly precipitation was .16 inches in 1892. The greatest amount of precipitation recorded in any 24 consecutive hours was 1.12 inches on the 1st, 1889. The greatest amount of snowfall recorded in 24 consecutive hours (record extending to winter of 1889-90 only) was 8 inches on the 11th and 12th, 1889.

CLOUDS AND WEATHER—Average number of clear days, 12. Average number of partly cloudy days, 10. Average number of cloudy days, 8.

WIND—The prevailing winds have been from the northwest. The highest velocity of the wind during any November was 48 miles on the 20th, 1891.

SEPTEMBER WEATHER REPORT.

The month of September, 1894, was warmer than the average, and generally very favorable for farm work and the maturing of crops. The mean temperature for the state was, 65.1°, which is 3° above the normal. The highest temperature reported was 100° at Mooar, on the 1st; lowest, 26°, at Rockwell City, on the 16th.

The average precipitation for the state was 3.57 inches, which is .13 of an inch below the normal. The southeast district reports the heaviest rainfall, the maximum amount being 7.43 inches, at Keosauqua; lowest amount, .59 of an inch, at Rockwell City.

At the close of September the records at the Central Station showed a deficiency of 12.39 inches in the amount of precipitation for the preceding nine months.

The heaviest storms of the month occurred on the 20th and 21st. On the 20th a severe thunder and hailstorm passed over Des Moines, causing many thousand dollars' damage by hail and flood in the city, and through the counties of Polk, Warren and Marion. The wind-storm on the evening of the 21st, passing through the counties of Clay, Palo Alto, Kossuth, Hancock, Worth, Mitchell and Howard, was accompanied by a group of small tornadoes, which caused the death of between 55 and 60 persons, and destroyed at least a half million dollars' worth of property. It was the most destructive storm of the year in the West.

The following table gives, as a basis of comparison, the mean temperature and total precipitation during the month of September, at the stations named, for the years from 1872 to 1894 inclusive:

YEARS.	MEAN TEMPERATURE, DEGREES.					PRECIPITATION, INCHES.				
	Des Moines.	Davenport.	Keokuk.	Omaha.	Sioux City.	Des Moines.	Davenport.	Keokuk.	Omaha.	Sioux City.
1872	....	65	68	62	....	.....	5.30	2.26	3.24	.....
1873	....	62	64	60	....	.....	1.00	3.37	1.86	.....
1874	....	65	68	63	....	.....	7.86	7.02	7.18	.....
1875	....	62	64	62	....	.....	4.05	4.62	2.55	.....
1876	....	62	65	62	....	....	5.50	11.08	4.93	.....
1877	....	67	69	66	....	.....	1.45	3.61	2.05	.....
1878	68	65	67	64	....	2.00	1.82	1.36	3.22	.....
1879	60	60	64	62	....	2 79	1.43	1.12	1.43	.....
1880	62	63	66	63	....	5.34	4.87	3.21	2.91	.....
1881	66	70	73	66	....	4.70	5.59	4.10	8.36	.....
1882	64	64	66	68	....	0.15	1.39	1.52	0.51	.....
1883	59	61	63	61	...	1.88	0.73	1.76	4.52	.....
1884	68	70	71	69	....	5.46	4.79	4.25	4.91	.....
1885	64	63	65	64	....	4.82	4.19	3.77	2.50	.....
1886	65	66	69	65	....	7.93	2.43	3.95	4.45	.....
1887	64	64	67	65	....	5.36	5.45	3.13	2.44	.....
1888	58	58	63	61	....	0.48	1.38	2.13	0.24	.....
1889	63	63	64	64	61	3.41	3.27	5.14	1.74	1.71
1890	61	60	63	63	62	1.57	2.34	4.46	2.50	2.26
1891	68	70	71	70	68	1.64	1.50	0.46	1.76	.91
1892	66	66	67	68	66	1.12	2.09	3.21	1.63	.57
1893	66	66	69	68	66	1.33	3.36	3.18	1.72	1.11
1894	67	67	68	67	66	4.46	3.02	4.86	2.48	.73
Means	64	64	65	64	65	3.20	3.26	3.68	3.00	1.23

SUMMARY OF WEATHER CONDITIONS.

BAROMETER—Mean pressure for the month, 30.00 inches. Highest observed, 30.52 inches at Clarinda on the 24th. Lowest observed, 29 50 inches at Sioux City on the 28th. Range for the State, 1.02 inch.

TEMPERATURE—Monthly mean as deduced from 71 Voluntary Observers' reports 65.1°. Highest monthly mean, 69.5° at Fort Madison. The lowest monthly mean, 58 6°, at Osage The highest temperature reported was 100°, at Mooar, on the 1st. The lowest temperature reported was 26°, at Rockwell City on the 16th. The

average daily maximum was 78.1°. The average daily minimum was 53.1°. The average monthly maximum was 94°. The average monthly minimum was 35.3°. The greatest monthly range was 70° at Elkader. The lowest monthly range was 48° at Fort Madison. The range for the entire State during the month was 74°.

RAINFALL—Average for the State as deduced from 76 Voluntary Observers' reports 3.57 inches. The largest amount reported was 7.43 inches at Keosauqua. The least amount reported was 0.67 inches at Ogden. The average number of days on which 01. inch or more rain fell, 8. Average number of cloudy days, 5; average number of partly cloudy days, 10; average number of clear days, 15.

HALO, SOLAR—Ovid, 10th and 12th.

HALO, LUNAR—Sac City, 8th.

PARHELIA—Ovid, 4th and 10th.

HAIL—Alta, 20th; Audubon, 9th and 20th; Cresco, 21st; Des Moines, 20th; Elkader, 8th; Emmetsburg, 21st; Forest City, 21st; Knoxville, 20th; Osage, 21st; Osceola, 20th; Ovid, 9th; Richland, 7th.

AURORA—Amana, 23d and 27th; Alta, 14th, 19th and 27th; Belle Plaine, 27th; Cresco, 19th and 27th; Emmetsburg, 27th; Grundy Center, 18th; Hopeville, 19th; Osage, 19th and 27th; Sutherland, 19th and 27th; Williams, 18th.

FROST, LIGHT—Was general over the northern part of the state on the 11th, and over the central and southern part of the state on the 18th and 24th.

FROST, KILLING—Alta, 24th; Audubon, 18th and 30th; Charles City, 24th and 25th; Galva, 17th; Grundy Center, 17th, 18th and 30th.

THUNDER-STORMS — Occurred on the 2d, 3d, 4th, 6th, 7th, 8th, 9th, 14th, 15th, 16th, 20th, 21st and 22d.

ATMOSPHERIC PRESSURE.

STATIONS.	Mean reduced barometer.	EXTREMES.			
		Highest reduced barometer.	Date.	Lowest reduced barometer.	Date.
Cedar Rapids	30.02	30.42	24	29.70	7
Clarinda	29 99	30.52	24	29.63	28
Cresco	30.03	30.47	24	29.59	21
Davenport	30.00	30.43	25	29.70	7
Des Moines	30.00	30.47	24	29.68	28
Keokuk	30.01	30.44	25	29.70	22
Omaha (Neb.)	29.98	30 50	24	29.61	28
Sioux City	29.94	30.51	24	29.50	28
Means	30.00	30.52	24	29.50	28

WIND MOVEMENT.

STATIONS.	Number of miles.	Maximum velocity.	Direction.	Date.
Davenport	5.677	36	NW	9
Des Moines	5.557	34	SW	22
Keokuk	4.617	36	W	6
Omaha (Neb.)	5,809	32	SE	28
Sioux City	8.208	44	S	13

OBSERVERS' NOTES.

Clinton—DR. LUKE ROBERTS: September, 1894, furnished very nice weather. The temperature of the atmosphere was 2.3° above a mean of the last 16 corresponding months. There were but three Septembers during this period that gave higher mean temperatures, viz: 1881, 1884 and 1891.

The maximum temperature was 94° and occurred on the 1st. The minimum was 36° and occurred on the 25th. The mean temperature for the month was 63.8°. The warmest day was on the first and the coldest day the last; the former gave a mean of 77.2°, and the latter 46.8°. Each of these was of a higher temperature than a September normal.

The number or storm days was nine, being about normal; but the precipitation was 2.09 inches in excess of normal. Total depth of water fallen, 5.26 inches. Two Septembers out of the sixteen gave a rainfall in excess of this—1880 furnished 6 57 inches and 1884 7.89 inches. The first rain after the 17th of August came on the 6th of September. This closed the second edition of the excessive drouth, and everybody seemed pleased; .73 of an inch of water fell between half past 11 and 12 o'clock in the evening, accompanied with intense thunder and lightning which lasted all night. Rain on the 7th with heavy thunder at 11:30 P. M. Rain, thunder and lightning on the 8th, and also on the 9th. Each of these storms was quite liberal in amount of rainfall, and modest in its behavior. The greatest precipitation in twenty-four consecutive hours since October 14, 1836, occurred on the 14th and 15th, commencing at 2 P. M. on the 14th with intermittent showers up to 4:15, when it entered upon a night's engagement which was prosecuted vigorously up to 6 A. M. of the 15th. Total precipitation 3.09 inches. The October storm mentioned above only went four hundredths of an inch better. Thunder and lightning accompanied the storm of the 14th and 15th. The 21st and 22d furnished some rain, the latter accompanied by thunder and lightning. At 9:15 P. M. the wind suddenly commenced blowing at the rate of 32 miles an hour and kept it up about fifteen minutes, when it gradually slowed up, but did not recede from a lively pace all the next day.

More thunder and lightning occurred during September than any month in the year. No serious damage is reported as resulting from the electrical disturbances. The movement of the wind for the month was 2,770 miles. This is 312 miles below normal. Prevailing direction of the wind, south and southwest. Maximum velocity, 32 miles an hour. Although September furnished an excess of rain, the streams and springs do not indicate it. Dry wells continue to increase, and the well diggers are in great demand in digging old wells deeper or making new ones. Old dug wells that have never before failed to furnish abundance of water have gone dry and the use of drill and tubing resorted to to replenish them with water.

Farmers are well pleased with September weather. The rains have put the soil in good condition for plowing, pastures and meadows greatly improved, and stock continued in thriving condition.

While the rains did not specially benefit maturing crops, it checked the liability to serious damage to fruit

trees, grape vines, etc., that might tell on next year's crop.

The first frost of the season made its appearance on the 24th, and was very light. The next morning another but more extended hoar frost reminded us of autumn's approach. This frost did but little damage, as the temperature of the air did not go below 36°. No more frost during the month. The smoky condition of the atmosphere which prevailed during the latter part of August continued for two or three days in September. The per cent of cloudiness was 36—slightly below normal. The clear days were 13, being about normal. Cloudiness prevailed least during evenings and greatest during mornings.

Bonaparte.—HON. B. R. VALE: The precipitation for the crop season, March to August, inclusive, for the last three seasons, is as follows: In 1892, 28.38 inches; in 1893, 20.92 inches; in 1894, 11 56 inches. With this falling off one-half we had an average crop of hay, oats and wheat, and a good third of a corn crop. The requirements for this section are about four inches per month for the crop season. With only 11.56 inches of rain during March, April, May, June, July and August, inclusive, the 7.32 inches this month barely wet up the streams, and yet this is the greatest monthly precipitation in the four years of my record.

Emerson—D. B. NIMS: The rains during September relieved the situation and the pastures and meadows resumed their usual verdure, except in places, which will have to be reseeded. An increased acreage of winter wheat has been sown. Sweet potatoes and cabbage have grown half their full size since the rains began, and apples increased in size 25 to 50 per cent. Some of the finest apples ever grown here will be shipped. Old corn can now be bought for 50 cents. Stock doing well.

Cedar Rapids—H D. OLDS: The mean temperature of 65.3° of the past month has been 24 above the average for the past ten years. The highest mean for September is 67.6° in 1891, the lowest 58.3° in 1885. Precipitation 3.86 inches is 0.95 inches above the normal for September. White frost was observed on several mornings but was too slight to damage vegetation except in a few localities. Pastures are better than at any time since June and stock is doing well.

Sutherland—W. H. BLOOMER: The tornado or series of tornadoes, seem to have originated about six or eight miles northwest of Sutherland. Near Gaza it took the roof boards off L. T. Gates' house. A corn field near there had a lot of corn shocks destroyed. Three miles due north of Sutherland a barn was destroyed and cottonwood trees broken down. Some damage was done northeast of Sutherland, and from there the storm moved into Clayton county.

Knoxville—CASEY AND REAVES: The hailstorm of the 20th began here at five o'clock P. M. Hundreds of window lights were broken and nearly all the apple crop was destroyed with some live stock.

BELATED REPORTS.

GALVA, August, 1894—Mean temperatura, 70.6°; highest temperature observed, 101°, on the 9th; lowest observed, 43°, on 3d. Total rainfall, 2.48 inches. Rain fell on 7 days. Number of clear days, 7; partly cloudy, 11; cloudy, 13.

MAXON, August, 1894—Mean temperature, 75.5°; highest observed, 106°, on the 9th; lowest temperature observed, 60°, on the 3d. Total rainfall, 0.60 inches. Rain fell on 3 days. Number of clear days, 26; partly cloudy, 5; cloudy, 0.

TOLEDO, August, 1894 – Mean temperature, 73.6°; maximum, 104°, on the 9th; minimum, 42°, on the 3d. Total rainfall, 0.96. Prevailing wind, west. Rain fell on 4 days. Number of cloudy days, 4; partly cloudy, 0; clear, 27.

FAYETTE, July, 1894—Mean temperature, 75°; maximum, 107°, on the 26th; minimum, 42°, on the 7th. Total rainfall, 21. Number of rainy days 1; cloudy, 0; partly cloudy, 5; clear, 26. Aurora, on the 7th.

ROCK RAPIDS, August, 1894—Mean temperature, 72.7°. maximum temperature, 100°, on the 8th; minimum temperature, 40°, on the 4th. Total rainfall, 1.28 inches. Number of clear days, 21; partly cloudy, 9; cloudy, 1; rainy, 3. Prevailing wind, south.

LARABEE, August, 1894.—Mean temperature, 74.1; maximum temperature, 103 on 8th—9th; minimum temperature, 40 on the 3rd. Total rainfall, 2.50 inches. Greatest amount in any 24 hours, 1.68 inch on the 13th.

TIPTON, July, 1894.—Mean temperature, 77.3; maximum temperature, 104 on the 26th; minimum temperature, 50 on the 7th. Total rainfall, .80 inch. Rain fell on 2 days. There were 28 clear days and 2 cloudy days during the month.

EXCESSIVE PRECIPITATION.

The following stations report heavy rainfall during September: Bonaparte, 3.05 inches on the 22nd; Charles City, 3.12 inches on the 6th; Clinton, 3.09 on the 15th; Des Moines, 2.60 inches in less than 12 hours on the 20th and 21st; Keosauqua, 2.25 inches on the 8th; Osceola, 2.82 inches on the 7th; Oskaloosa, 2.75 inches on the 20th and 21st; Richland, 3.86 on 20th and 21st.

SOLAR OBSERVATIONS, AUGUST, 1894.—ALTA, IOWA.

BY DAVID E. HADDEN.

Date.	CENTRAL TIME.	NUMBER VISIBLE		Faculæ.	Definition.	REMARKS.
		Groups.	Spots.			
1	5:00 P. M.	4	20	4	Good.	New group in extensive area of facula SE. large group of spots is E. of meridian.
2	5:20 P. M.	6	34	5	Good.	New small group by rotation. all the spots are small, a new group formed in S. latitude W. of meridian, two medium prominences on SW. and W. limbs.
3	5:25 P. M.	6	38	4	Good.	
5	5:00 P. M.	4	22	1	Good.	The facula is on E. limb, fine large double "cloud" prominence on SW. limb, also small prominence on E. and NE. limbs.
8	5:20 P. M.	4	27	3	Good.	Feather like prominence on SW. limb. Extensive elevation of chromosphere along W. and NW. limbs.
11	5:30 P. M.	5	14	3	Good.	Medium sized group in, on E. limb.
15	5:30 P. M.	5	34	2	Good.	Fine large group S. latitude E. of meridian bright protuberances on W. and SW. limbs. Extensive low prominence on W. limb.
17	5:20 P. M.	8	28	4	Good.	Fine large group little W. of meridian has two large spots and numerous smaller ones.
21	5:30 P. M.	6	18	4	Good.	The large group is near W. limb. Fine prominence NE. limb and jets on W. limb near large group.
25	5:50 P. M.	..	.....	3	Fair.	No groups or spots could be seen to-day, atmosphere was very smoky and sun's disc appeared of a deep orange color when observed in diagonal eye piece. No prominences could be observed either, the spectrum could only be seen from the B. lines in the green to the A. lines which were very conspicuous.
30	.....	2	about 10	2	Poor.	Very smoky atmosphere, extensive facula on SE. limb.
31	5:30 P. M.	2	about 12	3	Poor.	Smoky atmosphere.

METEOROLOGICAL DATA FOR SEPTEMBER, 1894.

STATIONS.	TEMPERATURE OF THE AIR. (IN DEGREES FAHRENHEIT.)								Precipitation in inches—Monthly.	Precipitation in inches—Greatest daily.	Prevailing direction of wind.	Killing frost—First of autumn.	No. of cloudless days.	No. of partly cloudy days.	No. of cloudy days.	No. of rainy days (.01 inch or more).	Hail-storms.	No. of thunder storms.
	Monthly mean.	EXTREMES. Mean maximum.	Mean minimum.	Maximum.	Date.	Minimum.	Date.	Monthly range.										
Afton	68.4	79.2	53.6	97	1	40	30	57	3.51	1.07	SW	...	16	6	8	7	..	7
Albia	66.0	79.6	52.5	97	3	34	18	63	3.91	1.70	...	...	...	...	...	9	..	..
Alta	64.6	77.7	57.5	92	1	34	24	58	1.14	0.76	S	24	18	7	5	4	..	..
Amana	64.6	75.9	53.4	93	1	35	25	58	4.05	1.69	S	...	18	10	2	10	..	7
Ames (Heilman)	...	...	...	...	...	...	...	...	3.03	0.99	...	17	...	...	...	6	..	..
Ames	64.9	78.3	51.5	95	1	31	18, 19	64	3.84	0.98	S SE	24	9	11	10	11	..	..
Atlantic	64.4	77.9	50.8	91	1	32	18	59	3.99	1.02	S	18	12	8	10	9	..	..
Audubon	63.6	76.4	50.9	93	1	35	18	58	5.27	1.97	S	18	11	8	11	7	2	5
Belle Plaine	64.3	76.6	52.1	96	1	33	24	63	3.88	0.98	S	...	...	...	...	10	..	4
Bonaparte	68.3	81 0	55.5	99	1	41	21	63	7.31	3.05	...	...	...	...	...	10	..	..
Cedar Falls	64.9	80.6	48 8	94	1	30	18	64	2.47	1.29	S	18	17	10	3	6	..	..
Cedar Rapids	65.3	74.9	55.6	91	1	38	21	53	3.86	1.48	S	...	17	8	5	10	..	..
Charles City	62.3	73.1	51.5	94	1	32	18	62	4.15	3.12	S	18	...	...	...	6	..	..
Clarinda	66.4	76.8	55.9	91	1	40	30	51	2.53	0.64	S	...	18	8	4	7	..	..
Clinton	65.4	77.2	53.6	94	1	36	28	58	5.26	3.09	S	25	12	12	6	8	..	..
College Springs	68.4	79.9	56.8	90	1	36	30	54	2.06	0.67	S	...	14	13	3	6	..	..
Corning	65.8	77.2	54.6	90	1	33	18	57	3.13	1.09	SW	...	16	8	6	9	..	1
Cresco	62.4	78.4	51.1	94	1	34	24	60	3.16	1.13	SW	18	18	8	4	8	1	5
Davenport	67.0	76.6	57.6	93	1	42	24	51	3.02	0.86	S	...	15	6	9	13	..	11
Decorah	62.3	74.3	50.4	95	1	31	18, 25	64	4.06	1.67	...	18	22	4	4	7	..	..
Delaware	61.4	...	...	94	1	37	24	57	3.48	0.78	S	24	15	10	5	10	..	..
Des Moines	66.7	77.6	55.8	93	1	37	18	56	4.46	2.60	S	...	18	7	5	12	1	5
Dubuque	66.2	77.5	55.0	95	1	33	30	62	3.86	0.96	S	...	12	3	15	10	..	..
Elkader	64.5	79.0	50.0	98	1	28	25	70	3.04	0.87	S	18	15	13	2	11	..	3
Emmetsburg	63.6	78.2	49.1	95	1	32	24	63	2.19	0.77	S	...	19	5	6	5	1	..
Fairfield	66.0	77.9	54.0	94	1	39	11	55	7.30	1.73	SW	...	...	...	...	13	..	..
Forest City	63.1	77.9	48.3	95	2	35	10	60	2.91	0.70	S	...	11	13	6	9	..	3
Ft. Madison	69.5	...	...	94	1	46	24	48	4.94	1.87	S	...	...	...	...	...	..	..
Galva	65.5	81.3	49.7	93	1	30	11	63	1.18	0 44	S	17	12	16	2	6	1	..
Glenwood	68.6	82.1	55.0	98	6	34	30	64	2.79	0 90	S	...	16	7	7	7	..	..
Grand Meadow	61.5	...	...	90	1	38	25	52	3.24	0.78	SW	...	10	16	4	9	..	1
Grundy Center	64.4	77.3	51.5	93	1	32	17	61	2.16	0.82	SW	18	17	10	3	6	..	..
Hampton	62.2	76.3	48.9	93	1	33	24	60	2.40	0.85	SW	24	14	14	2	8	..	1
Hopeville	66.7	78.4	55.0	93	1	40	35	53	3.48	0.89	SE	...	8	20	2	12	..	10
Hopkinton	61.7	...	...	...	...	...	...	...	5.09	1.30	SE	...	4	23	3	10	..	..
Humboldt	...	...	...	...	...	...	...	...	1.87	0 81	S	...	19	10	1	6	..	1
Independence	64.4	77.8	50 9	93	1	43	25	60	1.19	0.30	S	...	19	6	5	7	..	..
Indianola	66.6	81.0	52 3	95	1	36	23	59	4.53	1.30	NW	...	16	6	5	7	..	2
Iowa City	66.1	79.2	53.3	96	1	37	24	59	4.96	1.42	SW	24	8	13	9	12	..	..
Iowa Falls	61.2	75.4	47.1	94	1	28	18	66	1.57	0.68	...	18	...	...	...	8	..	..
Jefferson	65.4	81.5	49.4	95	1	33	24	62	2.58	0.65	S	24	7	23	...	9	..	..
Keokuk	68.0	78 0	59.0	95	1	44	24	51	4.86	1.22	S	...	14	8	8	15	..	..
Keosauqua	68 5	79.0	58.1	95	1	44	11	51	7.43	2.25	...	...	...	...	...	10	..	1
Knoxville	66.6	78.0	57.3	94	1	37	18	57	5.09	2.10	SE NW	...	16	9	5	9	1	..
Logan	65.3	78.8	52.5	96	1	35	30	61	2.22	0.88	S	...	22	3	5	4	..	..
Le Claire	...	...	...	...	...	...	...	...	3.92	2.02	...	...	...	...	...	8	..	..
Marshalltown	63.6	78.3	49.0	95	1	31	17	64	2.38	0.85	SW	...	...	...	...	8	..	..
Maxon	67.1	...	...	...	...	...	...	...	4.50	2.10	...	...	9	18	3	5	..	..
Mechanicsville	64.4	75.1	63.6	93	1	38	24	55	5.16	1.30	S	...	15	6	9	11	..	5
Monticello	62.8	74.8	52.9	91	1	32	25	59	3.35	2.13	S	...	17	9	4	9	..	..
Mooar	66.3	81.1	51.4	100	1	36	10	64	4.05	1.01	SW	18	11	1	18	11	..	2
Newton	65.8	77.7	53.8	92	1	36	18	56	2.23	0.75	S	..	16	10	4	11	..	..
North McGregor	...	...	...	...	...	...	...	...	2.70	1.57	...	...	...	...	...	9	..	..
Ogden	66.0	79.1	52.8	95	1	35	18	60	2.44	0.67	SE	...	24	...	6	8	..	..
Omaha (Neb.)	67.0	77.9	56.4	90	1	38	28	52	2.48	1.13	SE	...	15	9	6	8	..	..
Osage	58.6	...	...	...	...	...	...	...	4.11	1.85	S	...	14	9	7	10	1	5
Osceola	65.7	75.3	56.1	92	1	40	18	52	6.67	2.82	S	...	14	3	13	9	1	5
Oskaloosa	65.8	78.2	53.4	95	1	33	18	62	3 80	2.00	SE	...	17	6	7	7	..	..
Ottumwa	68.1	79 2	57.1	97	28	42	18	55	5.75	2.75	E	...	15	10	5	12	1	4
Ovid	68.1	81.2	55.0	96	1	39	18	57	4.94	1.80	SE	18	14	8	8	9	3	8
Panama	65.8	78.1	53.3	93	1	36	30	57	2.94	1.38	SE	18	19	7	4	6	..	..
Richland	64.7	...	...	...	...	...	...	...	6.16	3.86	...	...	11	18	1	11	1	..
Rockwell City	64.9	78.8	50 8	90	7	26	16	64	0.59	0.44	S	10	17	12	1	2	..	..
Rock Rapids	...	...	...	...	...	...	...	...	1.37	0.56	...	11	11	18	1	4	..	..
Sac City	63.6	76.1	51.1	91	1	35	11	56	2.25	0.75	SW	...	13	9	8	5	1	..
Seymour	68.5	82.3	53.4	97	1	38	30	59	5.93	1.72	S SE	...	18	7	5	8	..	..
Sibley	62.6	78.2	46.9	93	2	28	24	65	2.57	1.80	S	11	18	10	2	4	1	..
Sioux City	65.7	78.5	52.9	94	3	35	30	59	0.73	0.57	S	...	13	11	6	3	..	..
Sutherland	63.8	77 6	49.4	94	1	32	24	62	2.20	1.40	S	24	10	15	5	6	..	..
Toledo	64.0	80.5	57.7	94	1	34	18	60	2.61	0.96	...	...	16	10	4	8	..	..
Villisca	65.6	78.6	52.6	92	1	34	18	58	2.64	0.74	SE	...	20	6	4	8	..	..
Vinton	63.4	...	...	...	...	...	...	...	3.46	0.96	SW	18	18	8	4	9	..	..
Washington	66.2	78.1	54.3	96	1	38	24	58	6.15	1.87	SW	...	...	...	...	10	..	..
Webster City	63.7	...	...	96	1	35	24	61	2.15	0.65	SE	18	16	8	6	6	..	5
Williams	62.2	...	...	94	1	36	18	58	2.66	1.24	S	18	18	7	5	8	1	1
Winterset	66.2	79.1	53.5	91	1	38	24	53	5.72	2.12	NW	..	11	6	13	8	1	..
Means	65.1	78.1	53.1	94.0	...	35.3	...	58.6	3.57	...	S	...	15	10	5	8	..	..

DAILY AND MONTHLY MEAN TEMPERATURE FOR SEPTEMBER, 1894.

STATIONS.	DATE.																															Monthly Mean.
	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	
Afton	80	72	75	73	75	76	77	78	75	61	57	60	62	70	60	66	59	56	62	69	67	70	58	57	58	59	72	72	60	50	68.2
Albia	80	80	82	78	..	..	78	79	79	58	53	56	62	72	66	67	60	52	58	66	67	72	62	48	53	62	68	70	70	49	66.0
Alta	79	73	78	69	75	72	77	72	70	54	57	58	63	62	60	66	56	60	69	61	67	66	50	47	56	71	72	76	52	51	64.6
Amana	78	76	76	76	72	76	74	76	78	58	53	54	62	70	62	63	61	52	59	63	66	70	55	50	50	62	66	71	65	50	64.3
Ames	74	72	76	74	70	70	74	78	67	58	54	57	62	72	66	64	58	52	55	59	66	68	62	47	54	58	68	72	78	52	64.9
Atlantic	74	70	74	72	70	69	75	76	67	58	56	58	64	62	58	60	54	56	67	70	68	70	54	50	58	70	72	74	56	51	64.4
Audubon	78	72	76	70	71	72	74	75	68	57	53	56	62	66	58	62	56	54	53	59	66	68	52	51	54	62	69	72	57	46	63.6
Belle Plaine	79	79	76	76	.....		76	79	74	58	52	58	62	70	61	65	60	52	60	66	66	70	54	43	50	62	66	71	64	50	64.3
Bonaparte	80	81	72	75	74	79	80	80	80	63	59	56	66	74	67	67	68	59	62	66	68	72	58	52	54	64	70	72	70	56	68.3
Cedar Falls	76	76	78	76	74	76	76	78	69	61	70	62	60	58	58	54	61	52	63	61	64	68	58	52	48	64	64	67	63	50	64.6
Cedar Rapids	76	78	76	78	74	76	76	76	74	60	56	58	58	66	64	64	65	54	61	62	66	66	56	49	50	63	66	72	70	50	65.3
Charles City	79	77	76	74	75	65	78	76	67	56	53	57	61	67	53	64	56	48	60	59	59	58	51	44	47	64	64	74	55	50	62.3
Clarinda	73	73	76	76	74	75	77	76	74	60	58	59	66	67	60	66	58	57	65	69	69	69	56	53	60	70	72	72	58	50	66.4
Clinton	76	76	78	76	74	72	74	80	76	60	55	57	64	73	66	62	64	58	58	60	67	70	58	50	50	60	65	58	65	51	65.4
College Springs	80	72	74	75	75	77	87	75	78	64	59	59	68	69	62	64	59	58	67	66	76	71	65	57	60	80	79	75	60	51	68.4
Corning	78	72	74	72	72	75	76	76	74	60	55	58	64	68	61	65	59	54	66	70	68	71	55	50	58	70	73	73	60	50	65.8
Cresco	79	76	72	69	75	67	73	73	65	53	54	62	60	67	61	65	54	56	63	57	64	59	47	43	51	62	68	72	59	45	62.4
Davenport	80	78	76	76	74	77	77	80	78	61	57	60	62	74	66	66	66	59	62	66	67	68	57	50	52	62	69	72	69	51	67.1
Decorah	78	76	76	76	72	70	74	68	58	55	52	58	60	72	62	66	60	52	62	59	48	62	47	46	47	64	62	74	64	47	62.3
Delaware	74	73	74	73	74	71	72	70	67	55	52	52	59	70	56	58	58	50	58	57	63	66	50	44	48	58	61	68	61	47	61.4
Des Moines	80	74	74	76	75	72	75	78	72	60	56	59	64	72	64	66	61	56	64	68	68	72	55	52	58	69	72	76	63	52	66.8
Dubuque	80	80	75	77	74	74	74	74	72	62	56	56	61	72	66	64	65	55	62	65	70	68	60	49	49	62	58	72	70	56	66.2
Elkader	76	76	76	79	78	74	76	76	70	58	55	54	61	70	64	67	58	53	60	60	66	66	53	46	47	66	66	74	64	48	64.5
Emmetsburg	76	73	77	72	78	73	75	70	71	55	57	58	66	68	62	66	56	58	62	53	61	59	51	47	52	68	69	72	59	48	63.6
Fairfield	78	76	76	78	72	78	78	78	78	62	53	57	64	73	62	62	..	54	57	62	67	71	58	49	56	62	66	79	67	50	66.0
Forest City	74	78	78	70	70	77	69	63	63	50	58	60	66	67	64	64	64	50	54	67	52	63	57	49	45	56	65	68	68	58	63.1
Ft. Madison	83	80	78	72	73	74	82	84	80	64	61	60	68	76	68	69	63	60	63	72	73	72	59	54	59	66	71	72	74	55	69.5
Galva	75	68	73	68	72	72	78	77	62	59	52	57	64	58	60	63	56	63	68	.....											65.5
Glenwood	79	85	78	75	75	82	80	78	75	62	50	59	68	66	70	65	69	58	62	71	76	69	56	52	60	72	64	72	65	49	68.5
Grand Meadow	78	75	74	61	74	67	70	69	66	55	54	55	60	60	60	60	57	56	62	60	64	58	52	47	48	61	60	70	58	45	61.5
Grundy Center	78	73	73	70	78	73	74	72	62	52	58	62	66	66	66	62	50	62	64	62	67	66	49	48	59	66	74	74	62	46	64.4
Hampton	78	71	72	70	74	63	71	72	68	54	54	56	60	67	60	64	61	54	62	56	60	62	50	45	49	65	68	74	60	47	62.4
Hopeville	80	73	74	76	74	77	76	78	76	60	58	58	62	70	62	66	61	58	63	68	69	70	54	52	62	68	73	74	60	52	66.7
Hopkinton	71	70	71	72	68	71	70	72	64	57	51	53	60	58	62	62	59	51	57	60	64	66	51	46	46	59	70	68	65	47	61.7
Independence	76	74	74	76	73	74	73	76	68	58	53	56	58	68	62	64	62	52	60	61	66	68	59	46	48	62	66	71	68	58	64.4
Indianola	80	76	74	74	73	74	74	76	74	64	56	62	62	65	64	..	64	56	56	62	65	68	70	56	56	67	67	.....		60	66.6
Iowa City	78	77	76	76	74	77	74	76	74	63	56	55	61	66	65	62	65	56	60	63	68	71	62	56	52	63	68	71	68	52	66.2
Iowa Falls	76	74	76	70	71	....	76	75	66	56	62	54	59	71	60	67	54	51	62	58	65	66	51	50	54	66	66	71	62	48	61.2
Jefferson	76	77	76	74	72	72	76	76	69	61	54	60	63	62	65	64	60	55	62	66	68	68	61	48	57	65	70	70	70	49	65.4
Keokuk	80	80	77	74	71	76	78	82	82	64	58	53	66	76	64	66	67	62	63	68	70	71	57	53	56	64	72	75	70	53	68.0
Keosauqua	80	80	74	74	73	78	78	79	80	66	57	56	66	70	66	65	60	....	62	66	70	72	60	56	56	65	70	72	70	54	68.6
Knoxville	70	74	74	75	73	72	76	78	76	60	56	56	62	74	64	76	53	56	63	68	68	72	55	52	53	67	70	74	70	51	66.6
La Crosse, Wis	78	78	75	76	72	68	74	72	68	58	55	56	60	70	64	68	58	52	64	60	64	61	53	48	46	64	66	73	72	49	64.0
Logan	80	78	78	73	76	76	79	80	70	60	56	60	66	66	58	63	64	54	61	67	64	70	52	51	60	66	66	74	44	48	65.3
Marshalltown	79	78	72	73	75	72	75	75	72	50	56	58	64	66	62	64	51	54	64	66	65	62	64	48	48	....	64	66	72	62	65.6
Maxon	82	77	75	74	76	80	80	84	75	58	56	58	66	78	63	68	60	55	64	66	70	72	52	50	57	67	72	73	61	51	67.1
Mechanicsville	72	76	74	77	78	76	74	78	74	58	54	50	60	72	62	62	65	56	60	63	66	70	56	44	50	60	65	68	66	48	64.4
Monticello	76	74	75	75	74	73	74	73	70	55	53	58	61	71	60	64	57	52	58	62	62	66	50	45	48	58	64	66	57	45	62.7
Newton	76	74	74	76	72	74	75	78	74	60	56	58	62	72	62	64	62	54	61	65	67	71	59	50	54	66	68	73	64	52	65.8
Ogden	79	74	76	73	73	70	76	78	66	57	57	59	62	70	62	68	59	55	63	66	65	67	60	58	61	67	71	74	58	51	66.0
Omaha (Neb.)	80	75	77	74	76	74	76	76	68	60	58	62	68	62	63	66	58	62	68	70	70	72	56	54	61	73	74	75	56	50	67.0
Osage	72	71	73	62	68	68	72	67	63	51	48	54	60	62	54	59	50	50	58	61	59	55	47	44	48	60	62	69	52	43	58.6
Osceola	79	73	72	72	73	77	72	76	78	57	52	58	62	70	58	64	60	56	62	69	65	68	54	51	56	65	72	.....			65.7
Oskaloosa	80	76	74	74	71	77	76	78	76	60	55	56	62	72	62	66	64	53	60	66	68	70	56	55	55	64	68	72	64	41	65.8
Ottumwa	81	75	76	72	74	76	79	77	75	62	58	56	64	72	64	66	55	56	62	65	70	70	55	51	57	66	70	72	61	50	66.1
Ovid	81	74	84	76	80	78	76	82	80	62	60	58	63	74	64	64	65	55	64	69	72	74	56	55	58	68	72	74	64	54	68.1
Panama	79	74	78	72	76	74	78	75	68	58	56	60	65	62	58	62	56	58	66	70	67	68	52	53	60	71	72	74	60	48	65.8
Richland	76	74	75	72	70	78	80	80	76	54	50	54	62	70	66	70	58	55	60	64	68	65	53	49	55	65	66	68	61	46	64.7
Rock Rapids	72	63	71	68	67	77	78	75	67	50	54	60	70	62	56	61	60	63	67	64	65	67	56	52	58	74	74	76	61	58	64.8
Sac City	75	71	78	72	74	72	76	72	62	52	54	56	61	72	60	59	55	57	66	68	66	63	51	47	56	66	72	68	62	49	63.6
Seymour	78	76	78	76	78	76	78	81	81	60	64	55	65	75	70	66	58	62	66	68	69	76	64	53	54	67	72	76	72	52	68.5
Sibley	76	78	76	66	74	70	72	69	62	56	55	59	62	63	58	60	56	59	66	58	60	58	48	43	54	68	69	74	59	46	62.6
Sioux City	80	76	81	68	69	77	79	72	66	58	55	61	68	62	60	65	58	64	69	65	66	68	52	53	60	75	74	77	46	48	65.7
Sutherland	78	74	78	66	75	72	76	71	61	52	57	58	62	66	61	62	66	61	70	57	62	63	49	46	55	71	68	75	52	49	63.8
Toledo	78	76	76	76	72	74	74	78	71	58	53	58	63	67	62	64	64	54	60	62	64	66	56	48	48	70	66	72	66	50	65.4
Villisca	74	73	76	73	72	76	78	79	73	64	54	54	66	64	60	63	59	54	62	68	69	70	55	46	58	70	72	72	68	50	65.6
Vinton	78	74	75	76	74	74	75	74	65	56	48	57	61	66	62	66	58	55	60	60	69	66	51	45	54	62	68	71	50	48	63.4
Washington	80	78	76	74	74	78	77	76	77	60	55	55	62	72	64	65	62	55	60	66	68	70	55	52	54	64	60	72	65	51	66.2
Webster City	78	74	74	73	75	68	76	72	64	54	53	56	63	66	63	66	51	56	60	62	64	68	50	50	55	63	71	73	55	50	63.7
Williams	78	73	73	70	72	70	74	70	66	52	56	58	63	69	61	64	58	55	63	60	63	60	47	46	55	64	70	72	64	46	62.2
Winterset	79	78	74	79	78	78	76	76	74	55	52	58	62	74	61	65	60	55	64	66	67	69	51	45	55	67	71	74	57	48	66.8

MAXIMUM AND MINIMUM TEMPERATURE FOR SEPTEMBER, 1894.

| STATIONS. | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | | 9 | | 10 | | 11 | | 12 | | 13 | | 14 | | 15 | | 16 | | 17 | | 18 | | 19 | | 20 | | 21 | | 22 | | 23 | | 24 | | 25 | | 26 | | 27 | | 28 | | 29 | | 30 | | Mon'y Mean. | |
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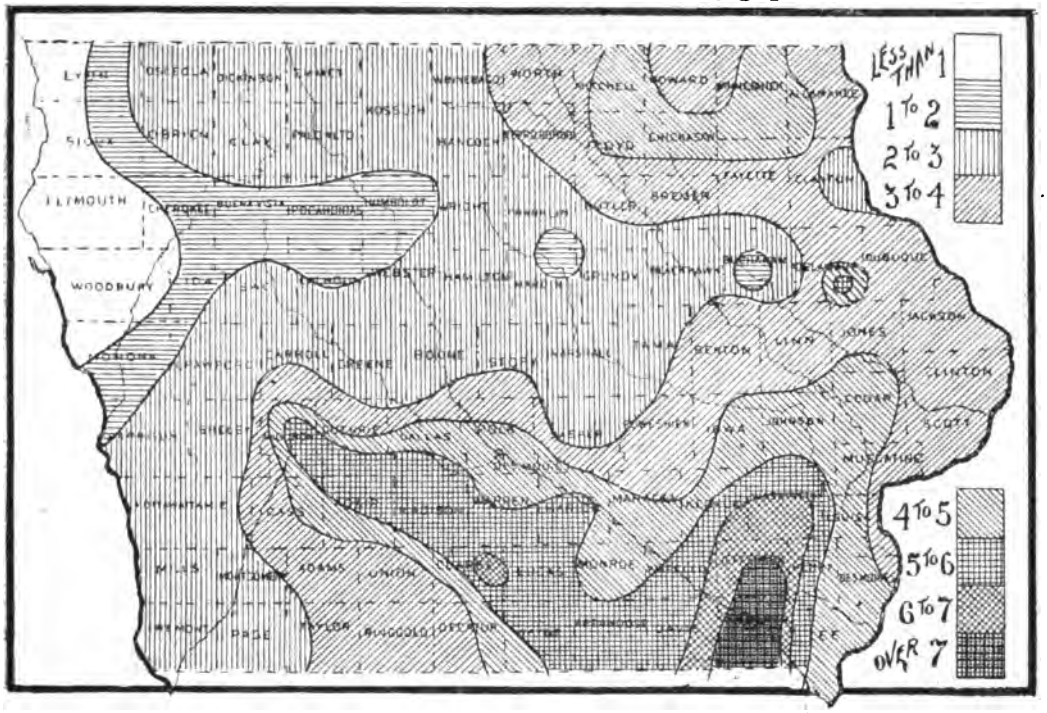
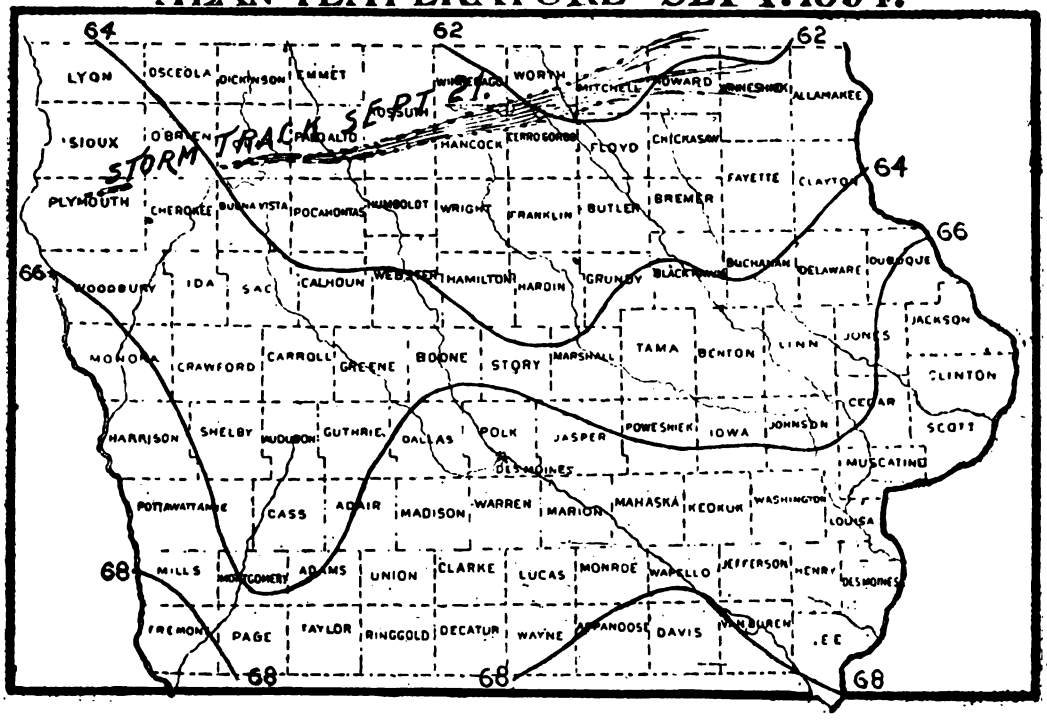
DAILY AND MONTHLY PRECIPITATION FOR SEPTEMBER, 1894.

STATIONS.	DATE. 1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th	27th.	28th.	29th.	30th.	Total.
Afton		1.07				0.20	0.44							0.42	0.24						0.44	0.70							T		3.51
Albia		0.33					0.57	0.05	0 19			0.02	T	0.09						1.70	0.91	T							0.05		3.91
Alta		T							0.06					0.22						0.76									0.10		1.14
Ames (Experiment Station)			0.52			0.52			0.99					0.54						0.31									0.15		3.03
Ames		0.05	0.54			0.25	0.26		0 98					0.36	0.14		0.08			0.90	0.13								0.17		3.84
Amana			0.22			0.17	1.69	0.27		0.25			0.26		0 59	T	T				0.35	0.07								0.18	4.05
Atlantic	T		0.17			0.60	0.40		0.69					0.69		0 12				1.02	0.18								0.12		3.99
Audubon							0.96		1.41					0.55		0.23				1.97									0.13		5.27
Belle Plaine		0.29	0.05				0 98	T	0.42			0.32		0.49		0.02				0.82		0.19							0.30		3.88
Bonaparte		0.78				0.47	0.70	0.25				0.19		0.79						0 98		2.63	0.42							0.10	7.31
Cedar Falls		T					0.60		0.53						0.01		0.01			0.03									1.29		2.47
Cedar Rapids			0.47			0.10	1.48	0.20	T	0.55			0.21		0.33		0.02				0.31	0.06							0.13		3.86
Charles City			0.45			3 12								0.33		T					0.07	0.08				T			0.10		4.15
Clarinda	0.17	0.64	0.39			0.43	0.42		T					0.33		0.15															2.53
Clinton					0.73	0.46	0.28					0.20			0.39						0.23	0.25							0.02		5.26
College Springs	T	0.67	0.40	0.07		T	0.39		T					0.41		0.12															2.06
Corning		0.49	0.33	1.09		0.18	0.18							0.52		0.09				0.11		0.14							T		3.13
Cresco		T	0.09			1.13			0.04					0.11						0.27	0.87	0.19							0.46		3.16
Davenport		0.08	0.03	0.11	T	T	0.17	0.04	0.26			0.08	0.07	0.38	0.86		T				0.44	0.46							T	0.04	3.02
Decorah						1.67	0.10	0.12						0.34								1.20	0.18						0.45		4.06
Delaware			0.02			0.53	0.39	0 45	0.65			0.11		0.78		0.01				0.26									0.28		3.48
Des Moines		T	0.53			0.36	0.49	T	0.01	0.01				0.13	0.18	0 01	T			1.89	0.71	0.08							0.06		4.46
Dubuque			0.80			0.30	0.96		0.45	0.02		T	0.13	0.36	0.58		T					0.06								0.20	3.86
Elkader			T			0.75	0.03	0.87	0.27				0.10	0.37		0.13				0.15	0.08	0.05							0.24		3.04
Emmetsburg						0.06			T					0.37						0.77	0 62	T							0.37		2.19
Fairfield		0.11	0.01	0.10		T	1.73	1.10	0.11			0.26		0.11	0.98						1.24	1.21	0.15						0.19		7.30
Forest City			0.03			0.40								0.70						0.49	0.76	0 09							0.44		2.91
Fort Madison		T	T	0.24		0.19						0.30		0.72			0.90			0.73	0.03	1.87							0.06		4.94
Galva							0.08		0.19					0.18						0.44	0.05								0.25		1.18
Glenwood		0.55	0.31			0.70	0.30								0.24	0.30													0 19		2.79
Grand Meadow						0.78	0.56		0.22				0.35	0.42		0.13				0.11		0.37							0.30		3.24
Grundy Center		T				0.10	T		0.44					0.27		0.05				0.82									0.48		2.16
Hampton		0.55	0.05			0.85			0.17					0.19		T				0.41	T	0 05							0.13		2.40
Hopeville		0.40	0.83			0.02	0 89	0.01	0.38					0.06	0.03	T	0.02				0.11	0.72							0.01		3.48
Hopkinton		T				1.30	0.02	0.40	1.05			0.23	0.40	0.20		T				0.18	0.35								0.26		5.09
Humboldt			T			0.40			0.10					0.81						0.35	0.01								0.20		1.87
Independence						T	0.10	T	0.22	0.08			0.30	0.12		T				0.22	T	T							0.15		1.19
Indianola		T	0.75			0.95	1.05	T	0.01	T				0.10						1.30	T	0.37									4.53
Iowa City		0.15	T			0.25	0.73	0.10	0.80	0.12		0.17		0.22	1.20						1.00	0.11							0.11		4.96
Iowa Falls						0.05	0.02		0.38					0.33		0.03				0.68	0.03								0.05		1.57
Jefferson			0.19			0.06	0.45	T	0.65					0.45		0 02			0.26	0.03									0.47		2.58
Keokuk		0.17	T	0.40	0.03	0.12	0.55	0.03		0.02		0.16		0.28	1.22		0.04				0.83	0.90	0.10							0.01	T	4.86
Keosauqua		0.63	T	T	T	T	0.84	2.25	T	T		0 11		0.10	0.77		T				1.35	1.22	0.02							0.14	T	7.43
Knoxville			0.29			T	0.55	0.25	0.08			T	0.07		T					2.10	0.60	1.10	T						0.05		5.09
La Crosse, Wis						1.81	1.67	T	0.01				0.22	0.19	0.08		T					0.88	0.04							0.10	0.14	5.14
Logan									0.68					0.28							0.85							0.21				2.22
Le Claire		0.07		0.21			0.11	0.26	0.70			0.24			2 02						0.31											3.92
Marshalltown		0.40	0.09		T	0.10	T	0.85				0.18		0.10	T	T				0.41	T								0 25		2.38
Maxon		0.40					0 65		0.30					T						2.10	1.05										4.50
[illegible]nicesville		T	0.15			0.37	1.03	0.83	0.83			0.15		1.07		0.02	T			0.37		0.17							0.17		5.16
[illegible]ntibello			0.08			0.86	1.27	T	0.33			0.15		0.43						0.06	0.01								0.23		3.35
Mooar		0.28	0.26	0.14	0.07	0.45			0 20			0.25		1 01			0.27			0.99			0.13								4.05
Newton		0.02	0.23			0.30	0.43	0.11	T					0.25		0.02				0.50	0.25	0.05							0.07		2 23
North McGregor						0.18	1.57	0.03		0 17			0.10		0.32		0.04				0.05		0.04							0.20		2.70
Ogden		0 24				0.10	0.43		0.67					0.65						0.19	0.10								0.06		2.44
Omaha, Neb	0.04	0.16	0.04			T	0.38		1 13					0.46		0.13													0.14		2.48
Osage			0.06	0.16		1.04	0.03		0.03					0.22						0.34	1.85	0.06							0.32		4.11
Osceola		0.14	0.58				2.82	0.36	0.65	T					0.38						1.62	0.09								0 03		6.67
Oskaloosa			0.24				0.81	0.25				0.10		0.37								2.00								0.03		3.50
Ottumwa		0.21	0.06	0.03		T		1.22	0 07	0.03		0.16	0.03	0.17					2.07	0.68		1.02							T		5.75
Ovid		0.30	0.45				1.32		0.08					0.50						1.80	0.06	0.40							0 03		4.94
Panama		9.16				0.10			0.75					0.54		0.06				1.38											2.94
Richland		0.05		0.01		0.55	0.61	0.02	0.04			0.21		0.85						2.33	1.33								0.16		6.16
Rockwell City									0.31					0.56						0.32		T							0.18		1.37
Sac City						0.10			0.40					0.75						0.75									0.25		2.25
Seymour		0.73	0.30				1.40	T	T			0.80		0.35	T	T				1.72	0.50									0.13	5 93
Sibley						T		T						0.18						1.80	0.05	T							0.50		2.57
Sioux City									T					0.05						0.11		T							0.54		0.73
Sutherland					T		0.18	0.01						0.04						1.40	0 24	T							0.33		2.20
Toledo		0.12					0 75	0 21	0.75				0.24		0.05					0.40									0.10		2.81
Unionville			1.49			0.01	1.24	T	T				0.24	0.24		T				0.88	0.30								0.06		4.45
Villisca	0.01	0.61	0.41	T		0.34	0 23		T					0.74		0.17					T	0.13							T		2.64
Vinton						0.11	0 90	0.18	0.96			0 24		0.06						0.40	0.18								0.20		3.46
Washington		0.01	0.08			T	0 43	1 87	0 23					0.35	0.18						1 40	1 65									0.15	6.16
Webster City				0.05			0 30		0 35											0 95		T							0 16		4 10
Williams							0 19							0 41																	2 52

PRECIPITATION SEPT. 1894.



MEAN TEMPERATURE SEPT. 1894.



METEOROLOGICAL STATIONS AND OBSERVERS

From the following, weekly and monthly reports of Meteorological data are received by the Iowa Weather and Crop Service.

Afton	Hon. N. W. Rowell.
Albia	Cal Koontz.
Albia (Maxon)	Gus Johnson.
Algona	C. D. Pettibone.
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Amana	Conrad Schadt.
Ames (Exp. Station)	W. H. Helleman.
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Atlantic	Geo. W. Franklin.
Audubon	J. F. Hocker.
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Belle Plaine	H. W. Vandike.
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Iowa Falls	J. B. Parmelee.
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Keosauqua	Prof. J. H. Landes.
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UNITED STATES DEPARTMENT OF AGRICULTURE
WEATHER BUREAU.

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MONTHLY REVIEW

OF THE

Iowa Weather and Crop Service.

VOL. V. —OCTOBER, 1894.—NO. 10.

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LOCAL FORECAST OFFICIAL,
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DES MOINES:
G. H. RAGSDALE, STATE PRINTER.
1894.

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U. S. Department of Agriculture---Weather Bureau.

MONTHLY REVIEW

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IOWA WEATHER AND CROP SERVICE.

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VOL. V.] OCTOBER, 1894. [NO. 10.

EDITORIAL NOTES.

The announcement of the University Extension lectures for the year 1894-95, includes a course of three lectures on meteorology, by Prof. A. L. Arner, who is well qualified to instruct and entertain the public. The lectures will embrace the following topics:

1. *Cloud formation.*—Processes involved; relation of cloud form to the method of formation. Cloud waves and ripples and their origin. Nomenclature.

2. *The origin and development of the cyclone; its movement and general control of weather changes.*—The tropical cyclone; the extra-tropical cyclone. Methods of the Weather Bureau.

3. *Local Storms.*—The thunder-storm; its essential convective nature. The tornado; general discussion of atmospheric whirls. Relation between local storms and the general cyclonic area.

It is gratifying to note the fact that this important branch of science is receiving a due share of attention in the schools; and it is to be hoped that Prof. Arner will have abundant calls to deliver the interesting course of lectures above outlined.

***

"It is believed," says Prof. Blodgett, "that the absolute fixedness of the measure of the sun's heat is capable of a demonstration as conclusive as that of any astronomical problem." If this is true there is no occasion to worry over the prospect of a change of climate that will materially affect the conditions of any part of the habitable earth.

***

"The capture of Niagara" is the title of an article by E. Jay Edwards, in *McClure's Magazine* for October, wherein one of man's greatest industrial achievements is described. The story of the harnessing of the thundering cataract, and converting its tremendous energies into electrical power to be used hundreds of miles away, reads like a fairy tale instead of a prosaic reality of this utilitarian age.

***

The new education, according to Prof. J. R. Buchanan, does not merely cram the mind with ancient facts and myths, but gives an acquaintance with all the facts of life to-day, here and now, and trains both mind and body. The hands and head should be educated together.

***

Energy manifests itself to us in various ways. To the physicist, light, heat, chemical action, and all other phenomena included in the category of the physical world are exhibitions of transformation of energy from one form to another. The sum total of energy in this world has never increased nor diminished. Like the matter in the universe, it is and will always be an unchangeable quantity. —*Electrical Age.*

***

J. S. Loomis, of Morris county, Kansas, gives his experience in feeding wheat to stock, in a letter to *The Orange Judd Farmer*. He says until pigs are six months old there is no grain feed equal to ground wheat. After six months they should have half and half, corn and wheat ground together. For milch cows wheat is better than corn. Ground wheat soaked three or four days in winter and one or two days in summer, will bring $1.00 per bushel fed to five cent hogs. In May of last year began feeding fourteen young pigs; gave them nothing but wheat, and at eight months sold them, weighing 304 pounds each. Other pigs, with all the corn they wanted, were sold at eleven months, weighing 230 pounds each.

***

Mr. C. L. Gabrielson says: "During an experience of twenty-five years on one farm an oat crop has never been a failure on account of frost. Alongside of barley, oats grows and ripens in the northern portions of Norway and Sweden, possibly within the limit of the Arctic circle, sown in soil thawed by the midnight sun to a depth of a few inches only. But it may be learned that those hardy Norsemen exercise as much precaution in selecting and saving their seed as do the most careful American farmers in providing seed corn for next year's crop."

***

Nature's forces work silently but irresistibly. No receptacle has ever been made strong enough to resist the expansive power of freezing water. It will rend a granite rock as effectively as dynamite.

The liability to damage from lightning, according to Prof. McAdie, is much less in cities and towns than in the country, the risk being about five times as great in the country as in the city. The probable reason of this comparative immunity in the city is the great number of wires and other metallic conductors which serve to dissipate and render innocuous the electric forces of storms.

***

The Michigan crop report for October says 18 per cent of the wheat crop of that State will be fed to stock. It will probably exceed that amount.

***

The distribution of thunder-storms has been studied by Prof. Klossousky, of the obsèrvatory at Odessa. He finds that a high temperature, a certain degree of humidity and a considerable rainfall are the principal agents favoring the development of thunder-storms. A zone of great electric intensity exists on both sides of the equator, in the part of which embracing tropical Asia and Oceania the yearly average is ninety to one hundred storms, while in tropical America—between 20 and 22 degrees north latitude—the mean annual number exceeds one hundred. North of the electric zones are the deserts of Africa and Central Asia, where rainfall is scanty, but north of the desert zone, in Europe and Asia, the electric activity is somewhat increased. For high southern latitudes data is scanty, but in the Falkland islands the storms average four.—*Exchange.*

***

Baled corn fodder has made its appearance in some of the towns of this State, and in the years to come it is likely to be more frequently seen in the market places. It is first shredded then baled, and in that form it is worth pound for pound nearly as much as good timothy hay. With wheat bran it makes a well balanced ration, especially for milch cows.

***

At a recent meeting of the British Association of Science was announced the discovery of a new element in chemistry. Lord Rayleigh and Professor Ramsey found that nitrogen is no longer an element but a compound; that nitrogen from air has a different density from that of the same gas obtained from other sources. When they treated what was supposed to be pure atmospheric nitrogen with magnesium, the nitrogen was absorbed, but a residue remained that proved to be a dense and remarkably inert gas, twenty-one times heavier than hydrogen and fifty per cent heavier than nitrogen. The spectrum was new, showing a single blue line, much more intense than the corresponding line in the nitrogen spectrum.—*The Medical Age.*

***

Prof. Jas. Wilson says: "After watching alfalfa during the drouth of 1894 we are inclined to give it further trial on suitable soils. We have seen it grow three good crops without irrigation on prairie soil, a little damp naturally, perhaps more so than rolling prairie. After it establishes itself it makes vigorous efforts to grow if it can reach moisture. There are many lands in Iowa where moisture can always be relied on and a deep-rooting legume that would grow repeatedly after being cut is just what is wanted, or a leguminous annual that is at home in a dry climate whether it can reach permanent moisture or not."

***

The most destructive cyclone of the season swept along the Gulf and Atlantic coast October 8-10th, causing great damage to property and considerable loss of life. Its first effects were observed at Galveston, and its tremendous force was not expended until it passed beyond Newfoundland.

REVIEW OF THE CROP SEASON, 1894.

The following review of the crop season of 1894 was recently submitted to the Chief of the U. S. Weather Bureau, answering a request in circular letter No. 31:

The crop season of 1894 opened under promising conditions, and farm operations were begun in this State from two to three weeks earlier than the average of recent years. The daily mean temperature of the first and second decades of March was about 15 degrees above the normal—the warmest weather on record in Iowa for the corresponding period in March. The soil was in excellent condition for plowing and seeding, and before the 21st of the month more than half the usual acreage of spring grain had been sown. The seed readily germinated, and all forms of vegetation were quickened into life. The last decade in March brought a most damaging change, the daily mean temperature being ten degrees below normal—making it the coldest on record. The minimum on the 25th and 26th was below zero at many points within the State, causing extensive damage to fruit buds, early planted vegetables and many fields of small grain.

April was warmer than the average, with plenty of moisture, giving promise of recovery from the disastrous set-back of the latter part of March. It was an ideal month for farm work and seeding operations, and the conditions were favorable for the growth of vegetation.

May was a month of extremes, giving a range of temperature from 90° to the line of damaging frosts, which occurred at nearly all points within the State on the 19th and 20th. This necessitated considerable re-planting of corn and tender varieties of garden truck. The average rainfall for the month was more than two inches below the normal, the bulk of the precipitation falling within the first decade.

The unprecedented drouth of this season began in Iowa about the middle of May, and from that time until about the 1st of September the heat was excessive, the sunshine almost continuous, and the few scattering showers were not sufficient to afford more than temporary relief from its blighting effects.

The daily mean temperature for June was 73.2 degrees about 4 degrees above the normal for the State. The average precipitation was 2.67 inches—2.28 inches below normal. The month, however, was favorable for cultivation of crops and on the first of July corn gave pro[mise] of considerably more than an average crop. Th[e] at that time had not materially injured corn, b[ut]

effects were shown in the short straw and reduced yield of spring grain and hay, and the generally burned out condition of pastures.

July added to the severity of the drouth by excessive temperature and hot winds. It was altogether the driest July ever experienced in Iowa since records have been kept. The mean temperature was 76.4 degrees—about 2.3 degrees above normal. The culminating period of the drouth was on the 25th, 26th and 27th, during which period the wind attained maximum velocities ranging from 25 to 38 miles an hour, and the maximum temperature ranged from 100 to 109 degrees. The average rainfall for the month was 0 63 of an inch—3.67 inches below the normal. Four stations reported only a trace, and fully three-fourths of the State received less than half an inch during the month. The mean relative humidity at the central station was only 46 per cent.

The first nine days of August were almost entirely rainless, and the month as a whole brought but slight relief from the severity of the drouth. The mean temperature of the month was 74 6 degrees—3.6 degrees above the August normal. The average rainfall was 1.58 inches —2.02 below the normal. About one-third of the State received less than one inch. The bulk of the rain for the month fell from the 10th to the 14th.

The average rainfall for the State during June, July and August amounted to 4.88 inches, which is 7.97 inches below the normal for the summer months. For the same period the average daily excess of temperature was 3 3 degrees.

September brought substantial relief, the rainfall and temperature being about normal. The pastures were revived, late potatoes made a good growth, and the remnant of the corn crop was generally matured without damaging frosts. The soil was sufficiently moistened for plowing, and there was an increased acreage of fall grain planted. The shortage of corn and hay necessitated the cutting of corn to save the fodder, and more than one-half the total acreage has been cut and secured in good condition for winter forage. And though the total crop output has been greatly reduced below the average the State at large has produced an abundance for the support of all its stock and all its people.

DEFLECTION OF THE ISOTHERMALS BY RIVER VALLEYS AND WATERSHEDS.

Doubtless, weather observers generally are aware of the fact that river valleys and watersheds have a marked influence in deflecting the isothermal lines. When the course of the valley is north and south the deflecting force is northward; while in the case of a watershed, on the contrary, it is southward. Such, at least, is the conclusion we may draw from a study of the isothermal charts for the state of Iowa. This state is nearly all embraced between two important north and south river valleys, viz., of the Mississippi and Missouri rivers. The divide between these two river systems lies well toward [illegible] western boundary of the state and comparatively close [illegible] Missouri river, so that the change from high land to low land is rather abrupt. Here, then, we find a narrow strip of territory, about one hundred miles wide, possessing strong influences on its east and west borders, which tend to deflect the isothermals in opposite directions. To show how pronounced these influences are, the writer has selected two stations—Omaha, Nebraska, and Atlantic Iowa, situated, the one upon the western and the other upon the eastern boundary of this territory and nearly on the same parallel, and has tabulated the following data with respect to them, viz., the mean temperature, maximum, minimum, mean maximum, mean minimum, and the temperature range. The period covered is from August, 1892, to January, 1893, inclusive, and was taken merely because the records at hand made it a matter of convenience.

AUGUST, 1892.

STATION.	Mean Temp.	Max.	Min.	Mean Max.	Mean Min.	Range.	Difference—Mean Max.	Difference—Mean Min.
Atlantic	72.1	102	43	87.5	56.7	59	4.8	...
Omaha	73.0	100	49	82.7	64 3	51	....	7.6

SEPTEMBER, 1892.

Atlantic	67.0	99	29	83.8	50.1	70	4.3	...
Omaha	68.0	86	42	79.5	57.5	44	....	7.4

OCTOBER, 1892.

Atlantic	54.8	96	14	73.4	36.3	82	5.5	....
Omaha.	57.4	87	27	67.9	46.9	59	....	10.6

NOVEMBER, 1892.

Atlantic	36.0	69	5	50.3	21.8	64	3.7	....
Omaha.	38.0	68	15	46.6	29.4	53	....	7.6

DECEMBER, 1892.

Atlantic	19.1	59	-24	34.2	4.0	83	5.9	...
Omaha.	22.0	50	-14	28.3	14.7	73	....	10.7

JANUARY 1892.

Atlantic	12.8	44	-21	27.0	-1.5	65	2.7	....
Omaha.	15.9	47	- 9	24.3	7.5	56	....	9.0

The mean temperature at Atlantic is seen to be lower than that of Omaha; and the temperature range is much greater. For example, in September the excess in the range for the former station amounts to 26°, and at no time in the period under consideration was it less than 9°, It is also to be noticed that there is a much greater difference for the mean minima than for the mean maxima. This is significant, and in the opinion of the writer furnishes an adequate basis for a satisfactory explanation of the observed deflection of the isothermals.

Among the factors which determine the temperature of a place are relative insolation and radiation, latitude, elevation above the sea, and the prevailing wind direction. There may be others, but we will omit them as these are the chief ones. A glance at the chart of the isothermals for the State will soon convince one that latitude, elevation above the sea, and wind direction have little if anything to do here, and that we are left to consider only those conditions which affect insolation and radiation. By insolation is meant that process by which solar energy comes to the earth, and radiation denotes the reverse process, namely, the passing out into space of heat from the earth. They are essentially one and the same in their

The [illegible] does not [illegible]

mode of working. By their operation energy is transmitted from one point of space to another by means of waves possessing a definite frequency and length. Like light radiant heat moves in straight lines from the center of thermal activity. A station therefore, situated upon an eminence will receive more heat than one upon a plane, and considerably more than one in a valley. In the latter case the valley sides offer an obstruction to the passage of the rays. But as the rate of insolation is not constant this obstruction will not be very marked. The rate of insolation varies with the altitude of the sun, and hence the valley sides would have their strongest influence when the rate of insolation was lowest. On the other hand the rate of radiation at night is more nearly constant. The valley sides intercept and throw back the rays from the lower places and a certain retardation is effected in the radiation. As a consequence the temperature in the valley will be higher than that upon the plane. From these considerations we would expect, then, for a lofty station a higher mean maximum temperature and a lower mean minimum; and that the observed differences in these means should be greater in the case of the mean minima. The theory here presented is not new, but its application in the present instance, it is hoped, will be not without interest.

ALBERT L. ARNER.
Physical Laboratory, State University of Iowa.

NATIONAL BULLETIN FOR OCTOBER.

WASHINGTON, D. C., November 1, 1894.

TEMPERATURE—October, 1894, was cooler than usual on the north Pacific coast, in portions of the east Gulf States, and over a limited area in the interior of Central California. No marked deficiency in temperature occurred in any of the districts named, the maximum deficiency of from 3° to 4° occurring on the north Pacific coast. While there was a slight deficiency in portions of the east Gulf States, it may be stated that the temperature conditions of the month were practically normal in the districts east of the Mississippi and south of the Ohio river, including the Atlantic coast States south of Maryland.

Throughout the Rocky Mountain slope, plateau regions, and over the northern districts from the Missouri valley eastward to the Atlantic coast the month was warmer than usual, the temperature excess averaging from 3° to 4° per day from central Texas northward over Kansas, Nebraska, and portions of Colorado and Wyoming, and from the upper Lake region eastward to the New England coast.

Some very high October temperature occurred in California, Montana, Colorado, and Texas during the first half of the month, a number of stations reporting the highest yet recorded in this month. At San Francisco the temperature reached 90° on the 4th, which is 3° higher than the previous October maximum, and at San Antonio, Texas, the maximum 98° on the 10th was 7° above the former highest October maximum.

The minimum temperatures of the month reached the freezing point throughout the Rocky Mountain districts, in the upper Missouri and upper Mississippi valleys, upper Lake region, and in portions of the upper Ohio valley and lower Lake region, those occurring on the 15th in the Lake regions and Ohio Valley being unusually low. Unusually low October temperatures also occurred in the central Mississippi valley on the 9th and 14th.

Killing frosts have occurred as far south as eastern Tennessee, but on the Atlantic coast, south of Virginia, and throughout the greater part of the Mississippi valley southward of St. Louis, no killing frosts were reported during October.

PRECIPITATION—The rainfall during October was heavier than usual along the west Florida coast and over the interior portions of the South Atlantic States. There was also more than the average October rainfall from the lower lakes eastward to the southern New England and middle Atlantic coast, from northern Wisconsin westward to Montana, and on the Pacific coast north of San Francisco. In southern New England, over the interior portion of the Carolinas, northern Minnesota, and on the extreme north Pacific coast the monthly rainfall exceeded the October average by more than 2 inches, and at some stations from 4 to 6 inches more than the usual amount were reported.

On the immediate south Atlantic coast, throughout the central valleys and west Gulf States, and thence westward over the Rocky Mountain and plateau regions to the south Pacific coast, the monthly rainfall was below the average, the deficiency amounting to 2 inches or more, on the south Atlantic coast and in the central Mississippi valley and from 2 to 4 inches in the west Gulf States. On the southern California coast, where the average October rainfall generally ranges from one-half to three-fourths of an inch, practically no rain fell during the month.

The absence of heavy or continuous rains over the western half of the cotton region during October was, doubtless, very favorable for securing cotton, while it is probable that the excessive rains over portions of the eastern half of the cotton region have been unfavorable.

Upon the whole, the weather conditions during October were generally favorable for farm work, especially for fall plowing and gathering corn.

MARK W. HARRINGTON,
Chief of Bureau.

THE WORK OF DUST.

Under the title "The Work of Dust," there is in the *Popular Science Monthly*, for September, a translation of an article by Dr. P. Lenard, originally published in German. Dr. Lenard says: "Dust has a very large share in nearly all the phenomena of the earth's atmosphere. It is what makes the clear sky appear blue; and when we look up into the sky we see the dust in the atmosphere illuminated by the sun. There is nothing else before us that can permit the light to reach the eye. Light goes invisible, straight through all gases, whatever their chemical composition. The dust catches it, reflects it in every direction, and so causes the whole atmosphere to appear clear, in the same way that it makes the sunbeam visible in the darkened room. Without dust there would be no

blue firmament. The sky would be as dark as, or darker than we see it in the finest moonless nights. The glowing disk of the sun would stand immediately upon this dark background, and the same sharp contrast would prevail upon the illuminated surface of the earth—blinding light where the sun's rays fall, and deep black shadows where they do not. Only the light of the moon and the stars, which would remain visible in the daytime, would be able to temper this contrast in a slight degree. * * *

"But if dust makes the sky appear clear, why is the color of the sky blue? Why does dust, of the different constituents of white sunlight, reflect the blue, rather than the green, yellow and red? This fact is connected with the size of the dust particles. Only the finest dust settles so slowly that it can be spread everywhere by means of the air currents, and can be found constantly in all strata of the atmosphere; and special importance can be ascribed only to these finest particles. The coarse parts soon fall to the ground. Let us consider the fine mechanism of light, the extremely short ether waves which determine its existence. These waves, although they are of even less than microscopic size, are not all equally long. The shortest are those that give blue light, while all the other colors are produced by longer waves. The fine atmospheric dust contains many particles which are large enough to reflect the short blue ether waves, fewer that can reflect green and yellow, and fewer still large enough to reflect the long red waves. The red light, therefore, goes on almost without hindrance, while the blue is more liable to be diverted and thus to reach the eye. A similar phenomenon may be observed on a larger scale on water which is roughened with waves of different lengths, and on which pieces of wood are floating. The pieces of wood stand in the same relation to the water waves as the dust particles to the ether waves. The great long waves pass the blocks undisturbed, only rocking up and down; while the finer ripples of the water are turned back as if the blocks were firm walls. * * *

"There is much coarse dust in large towns, when the sky over them is often gray, while only the finest blue dust is carried up in the country. The dust is also variously assorted at different heights above the surface of the earth. The coarser dust will be found at the lower levels, where it is produced. On the mountains we have most of the dust beneath us, while the rarified air can sustain only the finest floating particles. Hence the sky on high mountains is clear and deep blue, even almost black, as if it were without dust. Only when we look at the lower strata, toward the horizon, does the color pass into gray. Why is the sky in Italy and the tropics of a so much deeper blue than that of western Europe? Is the dust there finer? It is really so; not that a finer quality of dust is produced there, but because in the moist climate of the North Sea countries the dust cannot float long in the air without being charged with water and made coarser, while in warmer countries water exists in the air as vapor, and does not become condensed as a liquid on the dust. * * *

"Without dust there would be no condensation of water in the air—no fog, no clouds, no rain, no snow, no showers. The only condensing surface would be the surface of the earth itself. Thus, the trees and plants and the walls of houses would begin to trickle whenever cooling began in the air. In winter all would be covered with a thick icy crust. All the water which we are accustomed to see falling in rain-pours or in snow would become visible in this way. We should at once feel on going out of doors that our clothes were becoming wet through. Umbrellas would be useless. The air, saturated with vapor, would penetrate the interior of houses, and deposit its water on everything in them. In short, it is hard to conceive how different everything would be, if dust did not offer its immeasurable extent of surface everywhere to the air."

IS LIGHTNING MORE DESTRUCTIVE TO BARNS AFTER HARVEST TIME THAN BEFORE?

FROM MARYLAND WEATHER REPORT.

Inquiry was recently made of this office as to why thunder-storms were more destructive to barns after harvest time than before. The question was referred to the Weather Bureau, Washington, with the suggestion that statistics would show the truth or falsity of the statement, and the following reasons advanced in support of the assertion were also forwarded:

1. Before harvest the stalks of the grass and grain with their many pointed heads, like the trees of the forest, act as conductors of atmospheric electricity and afford protection in some degree to the buildings they surround. After harvest the dry stubble insulates a large proportion of the dry unwooded surface, and the electric tension is therefore relieved through the buildings as the best conductors afforded by a landscape denuded of trees and crops.

2. The overheated condition of a barn filled with harvested crops makes it a better conductor of electricity than a house or an empty barn, and the lightning seeks it the more quickly.

3. A barn filled with ripe crops is a more inflammable object than a house or an empty barn and is the more likely to be destroyed by fire resulting from a lightning stroke.

The Weather Bureau replied as follows: "It is doubtful whether statistics would throw light upon this question. Certainly the farmer and the whole community notice the destruction of a barn filled with the products of a year's labor more than they would notice the loss of an empty barn. For this reason all such cases would be reported, while the other might escape. It is proposed in the coming years to pay special attention to this and some other matters. It seems to us that the reasons given above in support of the greater destruction after than before harvest are all likely and not in contradiction with known laws. The second reason, however, is the one thought to be most effective. The heat, which is always to be found with packed hay and other crops, naturally makes a barn or stable warmer than the surrounding space. There is also with the warmth more or less moisture, and there are probably up-rising air currents, not very strong ordinarily,

but liable to be accentuated during thunder-storms. Again it must be remembered that barns are, as a rule, located on hills or hill-sides, and there may exist an air circulation due to topography.

These with the heat generated in the ripening of the crops tend to make a barn stocked more liable to be struck and also more inflammable than an empty one."

Prof. Jas. Wilson says: The Iowa acre is quite often so finely seeded down as to graze a steer six months. The steer gains 400 that sell in the market, when the steer has been finished with grain, at six cents a pound. The finishing is done with the grain from another acre during six months, that puts on the 400 pounds more. This is high water mark.

Engineers say there is nothing mechanically impossible in the matter of tapping the currents of rivers and the ocean tides and getting from them power enough to do everything at present accomplished by steam, coal and gas. The transformation that would take place in the modern city can hardly be painted by the wildest imagination.

DECEMBER'S PAST WEATHER RECORD.

DES MOINES—SIXTEEN YEARS' RECORD.

TEMPERATURE—Mean or normal, 25°. The warmest December was that of 1889, with an average of 40°. The coldest December was that of 1884, with an average of 18°. The highest temperature during any December was 69°, on December 24, 1889. The lowest temperature during any December was 20° below zero, on December 27, 1886.

PRECIPITATION—Average for the month, 1.43 inches. Average number of days with .01 of an inch or more, 7, The greatest monthly precipitation was 3.50 inches in 1882. The least monthly precipitation was .11 inches, in 1890. The greatest amount of precipitation recorded in any 24 consecutive hours was 1.30 inches, on the 25th and 26th, 1888, The greatest amount of snowfall recorded in 24 consecutive hours (record extending to winter 1884-5 only) was 17.0 inches, on the 25th and 26th, 1888.

CLOUDS AND WEATHER—Average number of clear days, 9. Average number of partly cloudy days, 11. Average number of cloudy days, 11.

WIND—The prevailing winds have been from the northwest. The highest velocity of the wind during any December was 36 miles, southwest and northwest on the 13th and 29th, 1889 and 1890.

DAVENPORT—TWENTY-THREE YEARS' RECORD.

TEMPERATURE—Mean or normal, 28°. The warmest December was that of 1877, with an average of 42°. The coldest December was that of 1876, with an average of 15°. The highest temperature during any December was 65°, on the 24th, 1889. The lowest temperature during any December was 22° below zero, on the 27th, 1886.

PRECIPITATION—Average for the month, 1.77 inches. Average number of days with .01 of an inch or more, 10. The greatest monthly precipitation was 3.84 inches in 1873, The least monthly precipitation was 0.36 inches, in 1876. The greatest amount of precipitation recorded in any 24 consecutive hours was 1.92 inches, on the 25th and 26th, 1888. The greatest amount of snowfall recorded in 24 consecutive hours (record extending to winter of 1884-5 only), was 6.7 inches, on the 20th and 21st, 1887.

CLOUDS AND WEATHER—Average number of clear days, 7. Average number of partly cloudy days, 12. Average number of cloudy days, 12.

WIND—The prevailing winds have been from the northwest. The highest velocity of the wind during any December was 52 miles, on the 18th, 1893.

KEOKUK—TWENTY-THREE YEARS' RECORD.

TEMPERATURE—Mean or normal, 30°. The warmest December was that of 1877, with an average of 45°. The coldest December was that of 1872, with an average of 18°. The highest temperature during any December was 69°, on the 24th, 1889. The lowest temperature during any December was 22° below zero, on the 24th, 1872.

PRECIPITATION—Average for the month, 1.94 inches. Average number of days with .01 of an inch or more, 9. The greatest monthly precipitation was 8.56 inches, in 1874. The least monthly precipitation was 0.03 inches, in 1890. The greatest amount of precipitation recorded in any 24 consecutive hours, was 2.61 inches, on December 11, 1874. The greatest amount of snowfall recorded in 24 consecutive hours (record extending to winter of 1884-5 only), was 5.4 inches, on December 12, 1885.

CLOUDS AND WEATHER—Average number of clear days, 7. Average number of partly cloudy days, 11. Average number of cloudy days, 13.

WIND—The prevailing winds have been from the northwest. The highest velocity of the wind during any December, was 50 miles, on December 15, 1876, from the northwest.

OCTOBER WEATHER RECORD.

DAILY JOURNAL AND MONTHLY SUMMARY.

OCTOBER 1. Cloudy A. M. in west and central districts, becoming general during the day. Light local rains at intervals, becoming general in afternoon and night. Rain at Des Moines, .71. Temperature, 42.8° at 7 A. M.; 56.8° at 7 P. M. Barometer, 30.142 inches at 7 A. M., 29.663 at 7 P. M. Wind, southeast and south; maximum velocity, 18 miles per hour.

2. Generally fair and cloudless in all districts except the northwest. At Des Moines, temperature at 7 A. M., 43 8°; 7 P. M., 63°. Relative humidity, 67 % and 52 %. Barometer, 29.728 inches, A. M., and 29,538 inches P. M. Wind, southwest and west; maximum velocity, 28 miles per hour.

3. Generally cloudy and cool, with traces of rain at intervals during the middle of the day. Temperature at Des Moines, 7 A. M. 44°; 7 P. M. 46°. Relative humidity, 63 per cent. Barometer, A. M., 29.728 inches; P. M., 29.830 inches. Wind, northwest; maximum velocity, 31 miles. Flurries of snow at Larrabee, Cherokee county, in morning and at other points in northwest. Windy and cold.

4. Generally cloudy and cool. Temperature at Des Moines, 7 A. M., 43.2°; 7 P. M., 47.7°. Relative humidity,

73 per cent and 68 per cent. Barometer, 29.887 A. M., 30.041 P. M. Wind, northwest; maximum velocity, 16 miles.

5. Clear, except cloudy in northeast in A. M. Maximum temperature at Des Moines, 52.2°; minimum, 39.7°. Barometer, 30.066 A. M.; 30.078 P. M. Wind, northwest; maximum velocity, 18 miles per hour.

6. Cloudy in west, clear in east in morning, followed by light rains in western part of the State in the evening, becoming general during night. Maximum temperature at Des Moines, 69 1°; minimum, 38.8°. Barometer, 30.068 A. M.; 29.865 P. M. Wind, south; maximum velocity, 21 miles.

7. Raining at Omaha and Davenport at 7 A. M.; cloudy in central districts. Light showers general during the day. At Des Moines maximum temperature, 55°; minimum, 44°. Barometer, 29.855 A. M.; 30.095 P. M. Wind, northwest; maximum velocity, 31 miles. Rainfall early in morning, .04; during the day, trace.

8. Generally clear. At Des Moines maximum temperature, 54.9°; minimum, 35.5°. Barometer, 30.206 A. M.; 30,110 P. M. Wind, northwest, fresh to brisk.

9. Clear, followed by increasing cloudiness in west and central districts. At Des Moines maximum temperature, 65.8°; minimum, 34.5°. Barometer, 29.969 A. M., 29.736 P. M. Wind, south to south, fresh.

10. Generally clear. At Des Moines maximum temperature, 62.4°; minimum, 40°. Barometer, 29.974 A. M.; 30.021 P. M. Wind, west to north, fresh to brisk.

11. Cloudy, except clear in the east in morning. At Des Moines maximum temperature, 65.1°; minimum, 34.2°. Barometer, 30.204 A. M.; 30 048 P. M. Wind, west to south, fresh.

12. Generally fair, except trace of rain in extreme east. At Des Moines maximum temperature, 68°; minimum, 45.3°. Barometer, 30,055 A. M.; 30.140 P. M. Wind, southwest to north, fresh.

13. Fair weather. At Des Moines, maximum temperature, 56 2°; minimum, 37°. Barometer, 30.287 A. M.; 30.244 P. M. Wind, northwest to north, light to fresh.

14. Partly cloudy during the day. At Des Moines maximum temperature, 58°; minimum, 30.5°. Barometer, 30.236 A. M.; 30.115 P. M. Wind, east to southeast, light to fresh.

15. Fair, except light rain in extreme southeast in early A. M. At Des Moines maximum temperature, 72.6°; minimum, 47°. Barometer, 29.996 A. M.; 29.932 P. M. Wind, southeast to west, light to fresh.

16. Clear. At Des Moines, maximum temperature, 80.9°; minimum, 47°. Barometer, 29.921 A. M.; 29.850 P. M. Wind, southwest to west; fresh to brisk.

17. Clear. At Des Moines, maximum temperature, 73.1°; minimum, 44.9°. Barometer, 29.957 A. M.; 29 909 P. M. Wind, east; light.

18. Generally fair, followed by light rains in central districts in P. M. At Des Moines, maximum temperature, 81 7°; minimum, 49.7°. Barometer, 29 871 A. M.; 29.772 P. M. Wind, south, southwest; maximum velocity, 28 miles. Rain at 7 P. M., .01.

19. Rain in central and eastern portions in early A. M., followed by clear. At Des Moines, maximum temperature, 73°; minimum, 58.5°. Barometer, 29.757, A. M.; 29.805, P. M. Wind, southwest to south; light. Rain at Des Moines, 0.31.

20. Clear in A. M.; rain P. M. and night. At Des Moines, maximum temperature, 81.5°; minimum, 56°. Barometer, 29.768 A. M.; 29.610 P. M. Wind, east to south; maximum velocity, 26 miles. Rainfall at 7 P. M., 0.30.

21. Cloudy, with light rain in the east during forenoon, followed by clear weather. At Des Moines, maximum temperature, 72°; minimum, 58.5°. Barometer, 29.649 A. M.; 29.868 P. M. Wind, west to northwest; maximum velocity, 27 miles; light during the day. Rain, 0.20.

22. Fair. At Des Moines, maximum temperature, 68.9°; minimum, 49.8°. Barometer, 30.051 A. M.; 30.101 P. M. Wind, east; calm to light.

23. Generally clear. At Des Moines, maximum temperature, 67.5°; minimum, 48.9°. Barometer, 30.161 A. M.; 30.302 P. M. Wind, northwest to north; fresh.

24. Generally clear. At Des Moines, maximum temperature, 69°; minimum, 39.5°. Barometer, 30.304 A.M.; 30.046 P. M. Wind, east to southeast; fresh.

25. Clear in morning; followed by rain except in southwest. At Des Moines maximum temperature, 72.5°; minimum. 50.1°. Barometer, 29.773 A. M.; 29.787 P. M. Wind, southeast to west; maximum velocity, 35 miles; rain, .06.

26. Clear, except rain in the east. At Des Moines maximum temperature, 60.1°; minimum, 41 8°. Barometer, 29.965 A. M.; 30.017 P. M. Wind, northwest, fresh, followed by light. Rain, 0.12 at 7 A. M.

27. Clear. At Des Moines maximum temperature, 67.9°.: minimum, 37.6°. Barometer, 30.006 A. M.; 29.772 P. M. Wind, south, light.

28. Generally cloudy, with light rains during the day. At Des Moines maximum temperature, 54.5°; minimum, 45°. Barometer, 29.648 A. M.; 29.715 P. M. Wind, south to west, fresh. Rain, .14.

29. Light rains, general. At Des Moines maximum temperature, 43 1°; minimum, 38.2°. Barometer, 29.661 A. M.; 29,681 P. M. Wind, southwest, light. Rain, .02.

30. Light rains in eastern and central districts followed by clearing during evening. At Des Moines, maximum temperature, 41°; minimum, 36.8°. Barometer, 29.740, A. M.; 29.819 P. M. Wind, northwest; light. Rain fall, 0.31.

31. Cloudy in A. M; clear in evening; generally fair. At Des Moines, maximum temperature, 54.8°; minimum, 33.8°. Barometer, 29.825 A. M.; 29.834 P. M. Wind, west; light.

The month, as a whole, was favorable for farm work and for the growth of grass and fall grain. The air was balmy, with a predominance of sunshine, tempered by the Indian summer haze peculiar to this region, making it one of the most pleasant months of the year.

The mean temperature of the month was 51.7 degrees, which is 2.2 degrees above normal. The average rainfal

was 2.67 inches—0.18 below the normal amount for October. The greatest amount reported was 5.25 inches at Ames, and the least, 0.63, at Mechanicsville.

The following table gives as a basis of comparison, the mean temperature and total precipitation at the stations named, for the month of October, for the years from 1872 to 1894 inclusive:

YEARS.	MEAN TEMPERATURE, DEGREES.					PRECIPITATION, INCHES.				
	Des Moines.	Davenport.	Keokuk.	Omaha.	Sioux City.	Des Moines.	Davenport.	Keokuk.	Omaha.	Sioux City.
1872	....	52	55	53	....	.....	0.61	0.42	3 89	.....
1873	....	48	49	54	....	.....	1.48	4.69	1.82	.....
1874	....	52	46	54	...	.....	1.30	1.94	1.45	....
1875	....	49	51	50	....	.....	1.63	2.71	1.16	... .
1876	....	49	52	50	....	....	1.54	2.12	0.69	.....
1877	....	54	56	52	....	....	4.48	7.11	5.86	.....
1878	50	52	54	52	....	2.84	4.21	2.31	0.55	.....
1879	60	60	62	62	....	3 15	0.92	0.28	3.64	.....
1880	49	51	52	50	....	4.90	0.94	2.02	3.54	.....
1881	55	56	57	55	....	6.40	6.85	8.01	4.84	....
1882	55	58	59	57	....	5.94	3.75	2.71	3.09	.....
1883	49	50	52	50	...	4.42	5.13	6.95	5.03	.....
1884	56	57	59	58	....	5.33	7.17	3.35	5.81	.....
1885	48	48	50	50	....	4.18	2.71	3.59	3.86	.....
1886	57	56	58	58	....	2.62	3.47	2.38	1.33	... ..
1887	48	42	51	52	....	1.24	3.41	1.38	0.72	.....
1888	47	47	51	52	....	0.84	2.81	1.63	1.16	.....
1889	49	49	51	52	50	0.52	1.26	2.88	0.34	.21
1890	52	52	54	52	50	4.48	3.63	2.44	1.09	1.84
1891	52	53	54	53	50	2.41	1.37	1.49	5.37	3.04
1892	55	56	57	57	55	2.54	0.55	0.71	1.23	1.32
1893	55	55	57	55	51	0.22	0.80	0.33	0.12	.58
1894	54	54	56	55	53	2.24	1.02	1.28	2.97	3.28
Means	52	52	54	54	52	3.19	3.04	3.24	2.57	1.71

SUMMARY OF WEATHER CONDITIONS.

BAROMETER—Mean pressure for the month, 29.93 inches. Highest observed, 30.38 inches, at Clarinda, on the 13th. Lowest observed, 29.44 inches, at Sioux City, on the 2d. Range for the month, 0.94 inches.

TEMPERATURE—Monthly mean, as deduced from seventy-three voluntary observers' reports, 51.7°. Highest monthly mean, 56.1°, at Ft. Madison. Lowest monthly mean, 46.3, at Osage. The highest temperature reported, 90°, at Glenwood, on the 19th. The lowest temperature reported was 20°, at Elkader, on the 14th. The average daily minimum was 40.6°. The average daily maximum was 63.7°. The average monthly maximum was 81.9°. The average monthly minimum was 27.9°. The greatest monthly range was 64°, at Glenwood. The least monthly range was 46°, at Davenport.

PRECIPITATION—Average for the State, as determined from seventy-six voluntary observers' reports, 2.67 inches. The greatest amount reported was 5.25 inches, at Ames; the least amount reported was .63 inches, at Mechanicsville; the greatest daily rainfall reported was 3 46 inches, at Ames on the 20th and 21st, and 2.77 inches, at Atlantic on the 20th and 21st.

HIGH WIND—Osceola, 20th; considerable damage being done in western part of county.

HALO, SOLAR—Amana, 13th.

AURORA—Amana, 5th, and Atlantic, 27th.

HAIL—Elkader, 25th.

SLEET—Emmetsburg, 29th; Grand Meadow, 30th.

FROSTS—Killing or freezing temperature occurred over the largest part of the State on the 8th and 9th.

SNOW FLURRIES—Generally throughout the State on the 28th, 29th and 30th.

ATMOSPHERIC PRESSURE.

STATIONS.	Mean reduced barometer.	EXTREMES.			
		Highest reduced barometer.	Date.	Lowest reduced barometer.	Date.
Cedar Rapids	29.94	30.23	24	29.62	29
Clarinda	29 95	30.38	13	29.56	29
Cresco	29 90	30.35	24	29.45	2
Davenport	29.92	30.31	24	29.53	2
Des Moines	29.93	30.30	24	29.52	2
Keokuk	29.95	30.31	24	29.56	2
Omaha (Neb.)	29.94	30 37	....	....	....
Sioux City	29.90	30.36	13	29.44	2
Means	29.93	30.38	13	29.50	1

WIND MOVEMENT.

STATIONS.	Number of miles.	Maximum velocity.	Direction.	Date.
Davenport	7,364	34	SW	25
Des Moines	5,912	35	W	25
Keokuk	6,542	36	W	25
La Crosse (Wis.)	5,744	28	S	25
Omaha (Neb.)	6,324	32	W	25
Sioux City	9 567	50	NW	25

OBSERVERS' NOTES.

Marshalltown—C. M. COOK: The absence of thunderstorms was remarkable throughout the past summer and autumn. There has been no appreciable damage reported from lightning.

Bonaparte—HON. B. R. VALE: Only two frosts during the month. Vegetation flourished during this time, and farm work is progressing nicely.

Cedar Rapids—H. D. OLDS: Severe thunder-storms on the 18th and 25th, but no damage done here. The first frost, sufficient to kill the grape-vines and foliage, was on the morning of the 5th; freezing weather on the 9th and later. More rain badly needed before winter sets in. Streams and wells very low.

Alta—DAVID E. HADDEN: Wind and rain storm on the 20th; came up very suddenly from southwest at 4:00 P. M.; first as a dust storm, followed by heavy rain and wind of great velocity; grew very dark during storm; much damage to outbuildings, sheds, etc.

BELATED REPORTS.

CARROLL—September, 1894: Mean temperature, 62.6°; maximum temperature, 94°, on the 1st; minimum temperature, 31°, on the 24th. Total rainfall, 3.29 inches. Rain fell on 5 days. Light frost on 24th.

MASON CITY—September: Mean temperature, 63.9°; mean maximum temperature, 78.9°; mean minimum temperature, 48.8°; maximum temperature, 93°, on the 1st; lowest temperature observed, 25°, on the 19th. Total rainfall, 1.78 inches. Rain fell on 8 days. Number of

clear days, 17; partly cloudy, 0; cloudy, 13. Light frost on the 11th; killing frost on 18th and 19th.

GREENFIELD—Mean temperature, 66.7°; mean maximum temperature, 79.9°; mean minimum temperature, 53.5°; maximum temperature, 95°, on 1st; minimum, 39°, on 24th. Total rainfall, 5.11 inches. Greatest daily precipitation, 1.73 inches, on the 20th. Number of clear days, 14; part cloudy, 9; clear, 7; .01 inch or more rain fell on 11 days. Thunder-storm on the 20th, and light frost on the 11th and 17th.

The following reports for September were sent to Washington by mistake, and were not received back in time to publish in the September Review:

Spirit Lake—Mean temperature, 65.2°; mean maximum temperature, 77.6°; mean minimum temperature, 52.8;. Highest temperature observed, 96° on the first. Lowest temperature observed, 31° on the 24th. Total rainfall, 1.39 inches. Number of rainy days, 5. Cloudy days, 7. Partly cloudy, 3. Clear, 20.

Larabee—Mean temperature, 64.6°; mean maximum temperature, 80.1°; mean minimum temperature, 49.2; maximum temperature, 94° on the 1st and 7th; minimum temperature, 31° on the 24th. Total rainfall, 1.03 inches. Number of rainy days, 8. Corn and vines on low ground killed by frost on 11th.

Algona—Mean temperature, 63.0°. Highest temperature observed, 92° on the 1st. Lowest observed, 38° on the 24th. Total rainfall, 1.28 inches. Number of rainy days, 5. Cloudy, 4. Partly cloudy, 8. Clear, 18. Killing frost on the 11th and 24th. Thunder-storms on 20th and 22d.

SOLAR OBSERVATIONS, SEPTEMBER, 1894.—ALTA, IOWA.

BY DAVID E. HADDEN.

Date.	CENTRAL TIME.	NUMBER VISIBLE		Faculæ.	Definition.	REMARKS.
		Groups.	Spots.			
1	5:20 P. M.	2	10 or 15	4	Good.	Very fine extensive prominence along the NW. limb. Small one E. limb.
3	5:40 P. M.	3	15	4	Good.	New small group in prominent facula SE. quadrant.
6	5:30 P. M.	6	17	4	Good.	Three new groups in, E. and SE. Faint group of spots near meridian S. latitude. Two groups faculæ around spots E.
10	5:25 P. M.	9	30	3	Good.	Prominent facula area SW., also E. Most of the groups are small. Extensive chromospheric elevation E. limb.
13	5:00 P. M.	6	about 25	6	Poor.	New group by rotation on edge of E. limb.
16	5:00 P. M.	6	25	2	Good.	Two groups are in extensive faculæ near W. limb.
18	5:25 P. M.	2	14	3	Good.	The two small groups are near meridian in S. latitude. Spots mostly small.
23	4:30 P. M.	6	12	3	Good.	Large fine double quiescent Prominence W. limb.
26	5:15 P. M.	3	7	2	Good.	The groups and spots are very small.
27	5:15 P. M.	4	15	2	Good.	New large round spot by rotation. Small group of eight spots SW. quadrant. Other two groups are small and faint.

METEOROLOGICAL DATA FOR OCTOBER, 1894.

STATIONS.	TEMPERATURE OF THE AIR. (IN DEGREES FAHRENHEIT.)								Precipitation in Inches—Monthly.	Precipitation in Inches—Greatest daily.	Total snowfall.	Prevailing direction of wind.	Killing frost—First of autumn.	No. of cloudless days.	No. of partly cloudy days.	No. of cloudy days.	No. of rainy days. (.01 inch or more).	No. of thunder storms.
	Monthly mean.	EXTREMES. Mean maximum.	Mean minimum.	Maximum.	Date.	Minimum.	Date.	Monthly range.										
Afton	53.3	65.0	41.0	83	18	29	9	54	3.53	1.50	T	SW	....	15	6	10	8	....
Algona	48.3	....	....	....	....	....	....	....	2.92	1.10	....	NW	....	14	10	7	8	....
Alta	49.6	60.6	38.5	82	20	28	8	54	3.18	1.57	4.00	NW	....	5	15	8	8	2
Amana	51.9	61.8	41.0	81	20	24	9	57	2.27	0.65	....	S	....	6	15	9	7	1
Ames	....	....	....	....	....	....	....	....	5.25	3.23	....	W NW	....	5	....	....	....	....
Ames (Hellman)	50.6	62.1	39.2	82	16, 18	23	14	59	4.71	3.46	....	NW	....	....	9	12	9	2
Near Atlantic	51.8	62.5	41.1	82	20	30	8, 11	52	4.75	2.23	....	....	....	6	13	8	10	2
Atlantic	50 5	63.2	37.1	83	20	25	11	58	3.78	2.77	T	NW W	....	5	16	4	11	3
Audubon	51.2	63.1	39.3	83	20	30	8, 31	53	4.15	2.45	....	NW	....	8	10	10	11	6
Bonaparte	55.3	67.7	42.9	83	15, 19	27	8, 13	56	1.71	0.49	....	....	....	....	....	....	....	....
Carroll	50.7	64.6	37.4	82	20	26	8	56	3.20	1.83	....	....	....	8	13	8	10	3
Cedar Falls	52.3	66.3	38.3	83	17, 18	24	9	59	3.07	1.27	2.50	NW	....	....	17	4	10	3
Cedar Rapids	52.2	61.2	43.2	78	20	31	9	47	2.23	0.74	....	NW	....	5	14	8	9	3
Charles City	48.8	....	....	80	20	26	9	54	2.46	0.90	....	NW	....	9	....	....	....	....
Clarinda	53.9	64.5	43.3	83	20	31	31	52	2.77	1.47	2.50	NW	....	....	20	6	5	3
Clinton	52.0	62.2	41.8	81	20	28	14	53	1.84	0.75	....	NW	....	6	9	15	7	1
Corning	52.6	65.0	40.3	84	20	31	8, 31	53	2.31	1.12	T	NW	....	....	22	2	7	4
Cresco	49.2	59.0	38.9	78	18	27	14	51	3.64	1.25	....	NW	....	....	11	9	11	12
Davenport	54.0	62.2	44 8	80	20	34	14	46	1.02	0.38	....	SW	....	....	8	10	13	3
Decorah	49.7	61.0	38.5	78	18, 20	23	14	55	2.83	0.80	....	....	....	....	18	5	8	....
Delaware	48.2	....	....	....	....	....	....	....	2.66	0.97	....	S	....	....	8	11	12	2
Des Moines	54.0	63.8	43.3	82	18	30	14	52	2.24	0.48	....	NW	....	8	15	7	9	3
Dubuque	52.0	63.4	41.1	80	18	30	9	50	1.39	0.42	....	NW	....	9	7	13	11	1
Elkader	50.1	62.3	37.9	82	16, 18	30	14	62	2.87	0.74	....	NW	....	....	10	11	10	14
Emmetsburg	48.7	61.8	35.9	83	18	22	14	61	2.20	1.05	T	N NW	6	20	2	9	....	....
Fairfield	53.2	63.9	42.5	81	20	24	14	57	2.31	0.65	....	....	9	12	16	3	....	....
Forest City	49.0	61.2	36.9	81	19	25	11	56	3.50	1 30	....	S W	....	....	11	9	20	7
Ft. Madison	56.1	....	....	....	....	....	....	....	1.71	0.59	....	S SW	....	9	11	10	10	16
Glenwood	55.8	69.1	42.5	90	19	26	31	64	3.65	1.64	T	S	....	....	22	5	4	3
Grand Meadow	49.0	....	....	....	....	....	....	....	2.87	0.96	T	S SW	1	9	13	9	10	....
Greenfield	53.2	67.4	42.2	83	20	31	31	52	2.10	0.74	T	W	4	18	6	7	8	1
Grinnell	53.4	62.0	44.1	87	15	34	31	53	2.74	0.60	....	S	....	....	15	7	9	2
Grundy Center	50.8	61.9	39.7	81	18, 20	25	13	56	3.37	1.40	....	NW	8	17	5	9	9	1
Hampton	48.6	60.5	36 6	80	25	26	14	54	3.91	1.33	....	NW	5	13	12	6	6	....
Hawkeye	....	....	....	....	....	....	....	....	2.70	0.58	....	....	....	....	....	....	....	....
Hopeville	53.6	64.6	42.7	82	20	32	8, 9, 31	50	2.29	0.73	....	NW	....	10	14	7	10	2
Humboldt	....	....	....	....	....	....	....	....	3.26	0 90	....	S	....	11	11	9	11	....
Independence	50.6	62.7	38.7	81	20	25	11	56	1.93	0.60	....	SE	....	14	10	7	7	....
Indianola	55.2	67.1	43.3	81	16, 18	32	14	49	1.09	0.45	....	NW	8	....	....	....	....	....
Iowa City	54.2	66.6	41.8	87	16	27	9, 14	60	2.30	1.04	....	NW	....	11	9	11	8	1
Keokuk	56.0	66.0	46.0	83	16	31	14	52	1.28	0.42	....	SW	9	13	13	5	9	....
Keosauqua	55.9	67.1	44.7	83	16	30	9, 14	53	1.83	1.00	....	....	....	....	....	....	....	....
Knoxville	54.6	66.5	42.9	85	16	30	14	55	3.04	1.08	....	NW	....	15	9	7	7	....
Larrabee	50.3	63.1	37.5	83	20	26	13	57	2.85	1.58	....	....	8	....	....	....	....	....
LaCrosse	50.0	58.9	42.1	76	16	27	14	49	1.90	....	....	S	9	8	13	10	13	1
Le Claire	....	....	....	....	....	....	....	....	1.58	0.49	....	....	....	....	....	....	....	....
Marshalltown	49.0	61.0	37.0	82	17	24	8	58	1.89	0.68	....	SW	....	0	16	15	6	....
Mason City	48.7	62.7	34.5	80	18	22	14	58	3.86	1.35	....	....	....	18	0	13	9	....
Maxon	53.1	....	....	....	....	....	....	....	1.62	0.35	....	....	....	8	19	4	16	....
Mechanicsville	52.3	62.3	42.2	80	20	29	9	51	0.63	0.28	....	W	....	4	11	16	6	....
Monticello	49.5	....	....	....	....	....	....	....	2.11	0.73	....	S NW	1	14	8	9	10	1
Mt. Pleasant	52.7	....	....	....	....	....	....	....	1.77	0.51	....	SW	8	22	7	2	8	....
Mt. Vernon	52.2	....	....	....	....	....	....	....	2.71	0.62	....	NW	....	15	8	8	11	....
Newton	52.3	63.4	42.0	82	18	27	9	55	2.29	0.70	....	....	....	....	....	....	....	....
North McGregor	51.9	64 8	39.0	83	16, 20	28	13, 14	55	3.82	1.98	....	NW	8	19	0	12	8	....
Ogden	55.0	65.7	44.3	84	16	31	31	53	2.94	...	....	NW	8	16	6	9	7	....
Omaha (Neb.)	46.3	....	....	....	....	....	....	....	3.38	1.33	....	NW	1	10	9	12	8	3
Osage	48.7	....	....	....	....	....	....	....	2.86	1.38	....	NW	....	15	3	13	11	1
Osceola	53.5	65.2	41.5	82	20	24	9	58	1.66	0.62	....	W	....	19	3	9	6	....
Oskaloosa	54.6	65.7	43.6	83	16, 18	28	14	55	3.33	2.20	....	W	9	15	9	7	10	1
Ottumwa	54.3	66.3	42.3	83	16, 18	30	14	53	3.69	1.81	T	NW	9	15	7	9	10	2
Ovid	52.3	64.8	40.4	83	20	25	13	58	2.71	1.70	4.0	SW	....	18	3	10	4	....
Panama	52.9	....	....	....	....	....	....	....	1.66	0.63	....	....	6	9	19	3	9	....
Rockwell City	48.8	61.2	36.7	82	18	28	8	54	3.80	1.64	....	....	7	17	7	7	10	....
Sac City	49.6	59.9	39.1	77	19	30	11, 12	47	3.10	1.25	....	Nw Sw	8	15	6	10	6	....
Seymour	55.3	66.9	43.8	83	16, 20	31	14	52	1.96	0.66	....	NW	9	16	8	7	4	....
Sibley	49.6	63.1	36.2	80	18, 26	26	13	54	2.94	1.27	T	NW	....	13	7	10	9	....
Sioux City	53.0	64.0	41.3	83	16	29	31	54	3.28	....	....	NW	....	13	9	9	9	....
Villisca	51.8	64.7	38.9	80	18,19,20	27	14	53	2.35	2.03	....	NW	8	18	8	5	5	....
Vinton	50.0	....	....	....	....	....	....	....	2.32	0.52	....	NW	5	15	9	7	7	....
Washington	52.7	64.7	40.8	83	18, 20	23	31	60	1.56	0.50	....	NW	9	....	....	....	....	....
Waukee	52 2	64.2	40.0	81	18	32	9	49	1.88	0.48	....	NW	8	6	11	14	7	2
Webster City	48.4	....	....	....	....	....	....	....	4.35	2.05	....	NW	8	18	8	5	4	2
Williams	48.2	....	....	....	....	....	....	....	3.11	0.94	....	NW	....	16	6	9	9	....
Wilton	52.0	62.8	41.1	80	18	28	11	52	1.76	0 98	....	W	....	16	7	8	11	....
Winterset	52.4	64.7	40.1	83	18	29	14	54	1.75	0.58	....	NW	....	15	4	12	5	....
Means	51.7	63.7	46.0	81.9	....	27.9	....	56.1	2.67	....	....	NW	....	14	8	9	8	1

c of

STATIONS.	DATE.																														Monthly Mean.
	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.	31st.	
Afton	56	60	50	45	47	60	53	42	47	44	57	58	49	46	54	56	58	65	64	69	65	62	58	54	60	50	58	57	45	37	42	53.3
Algona	48	54	42	45	43	54	41	41	50	44	51	46	39	48	53	59	49	62	61	63	58	58	48	54	51	43	54	46	37	36	36	48 3
Alta	46	56	41	42	44	54	40	41	51	46	49	52	43	45	56	62	55	61	61	68	58	56	54	56	54	46	54	42	32	33	39	49.6
Amana	45	62	46	48	42	46	51	44	42	50	56	58	45	40	57	58	54	60	64	67	64	54	58	59	59	50	48	54	44	41	40	51.9
Ames	44	61	44	45	46	48	50	44	45	47	46	54	46	41	58	64	..	64	66	67	62	56	55	50	....	50	48	46	40	38	44	50.6
Atlantic	46	59	44	44	48	56	42	43	48	47	45	52	44	41	58	57	54	59	66	70	64	53	54	50	48	50	50	45	34	34	50	50 5
Atlantic (near)	52	58	51	44	46	53	46	42	50	49	48	54	46	46	56	60	58	66	66	70	60	59	56	56	60	48	53	46	34	35	40	51.8
Audubon	48	58	49	44	45	54	52	41	48	47	50	54	44	44	56	60	56	62	64	70	61	56	54	54	58	47	50	51	38	34	40	51.2
Bonaparte	55	67	52	48	51	49	56	46	48	52	50	60	48	44	56	65	62	66	64	59	70	64	50	67	58	52	50	58	52	40	43	54.8
Carroll	48	51	46	45	52	49	43	40	50	54	50	51	45	45	58	61	59	60	60	66	58	52	52	55	58	51	60	39	34	43	39	50.7
Cedar Falls	46	64	55	45	42	46	46	46	44	49	50	40	48	51	58	62	62	60	62	60	62	60	52	50	59	56	52	50	50	52	42	52.3
Cedar Rapids	50	64	48	48	46	46	44	44	45	50	48	58	46	43	56	60	57	60	58	67	64	58	60	52	56	53	50	56	45	44	43	52.2
Clarinda	54	62	50	47	50	58	50	44	48	51	52	58	48	46	59	62	60	66	68	72	65	59	60	56	60	52	54	52	38	35	40	53.9
Clinton	48	63	50	46	46	47	56	44	44	48	48	58	45	41	52	60	55	60	60	65	62	58	62	47	54	54	52	56	49	42	42	52.0
Corning	54	61	50	46	47	58	55	43	50	50	50	57	46	46	60	62	57	..	....	68	64	58	58	56	64	52	54	53	38	36	42	52.6
Cresco	46	58	46	45	43	46	45	42	45	46	45	52	40	40	52	58	50	57	62	64	58	54	52	50	54	49	47	54	42	41	39	49.2
Davenport	52	64	48	46	46	48	57	45	46	50	50	58	45	44	53	64	61	62	64	67	64	60	62	50	57	52	54	58	45	42	42	54.0
Decorah	46	58	50	44	44	46	47	42	44	47	46	54	45	38	52	53	48	54	61	66	64	53	56	48	55	48	50	52	48	42	40	49.7
Delaware	44	60	44	45	44	44	49	41	40	45	43	46	39	37	51	51	54	60	58	64	62	52	50	44	51	51	44	52	44	42	40	48.2
Des Moines	51	64	46	46	48	54	50	46	50	51	50	56	46	44	60	64	59	66	66	69	65	60	58	54	61	51	53	50	40	39	44	53.9
Dubuque	49	63	54	52	52	48	46	46	45	50	48	58	48	40	50	61	57	58	64	64	64	56	61	53	50	49	47	56	52	42	41	52.4
Elkader	46	62	44	46	46	46	51	44	44	50	43	58	42	40	50	56	52	56	64	62	60	55	55	48	54	48	50	54	46	41	40	50.1
Emmetsburg	42	57	41	42	41	41	51	50	42	49	45	49	50	41	53	62	52	59	64	65	59	56	52	50	56	45	54	42	32	32	39	48 8
Fairfield	52	64	51	47	46	47	54	44	43	50	48	57	47	41	58	61	57	62	63	68	62	60	60	47	63	52	49	50	47	41	43	53.3
Forest City	44	49	53	42	41	41	51	39	44	50	42	46	45	40	48	52	58	51	64	66	67	56	58	54	50	51	44	48	44	36	41	49.0
Ft. Madison	59	68	53	52	46	54	56	47	50	52	58	58	46	48	60	61	62	68	70	71	65	56	62	59	59	52	54	52	46	41	44	56.1
Glenwood	51	60	54	55	47	59	44	44	53	50	52	..	52	48	64	62	58	66	72	73	62	58	60	67	62	57	54	63	45	34	45	55.8
Grand Meadow	46	56	42	46	44	50	45	40	46	44	48	52	40	42	52	62	50	60	59	58	52	54	55	50	50	49	49	52	43	40	42	49.0
Greenfield	50	57	49	44	45	49	50	49	50	53	55	59	50	51	45	55	61	65	62	68	63	60	62	62	60	50	52	51	39	37	42	53.2
Grinnell	58	61	54	45	45	49	54	46	48	49	50	51	46	48	66	62	54	64	64	66	63	59	57	53	58	50	52	56	44	39	37	53.4
Grundy Center	53	56	44	43	42	58	42	41	50	44	53	59	38	47	58	61	54	68	62	69	56	60	48	56	56	46	52	43	40	42	40	50 8
Hampton	43	58	43	43	40	45	42	41	48	45	46	52	42	41	56	56	56	57	62	58	56	52	49	56	47	48	46	40	36	44	44	48.6
Hopeville	52	64	49	55	48	56	50	44	48	50	52	56	46	46	60	64	61	66	65	68	65	60	56	56	64	50	54	50	39	36	42	53.6
Independence	45	60	54	44	42	46	53	44	44	46	44	54	46	41	46	58	56	61	64	66	65	56	56	48	56	51	46	48	46	42	42	50.6
Indianola	50	64	55	58	60	56	58	44	45	49	52	58	51	48	59	62	60	66	66	66	69	68	60	...	57	50	53	48	46	38	44	55.2
Iowa City	46	65	54	46	46	46	52	46	44	56	48	59	50	42	60	62	62	64	68	68	70	58	64	54	59	58	53	54	49	42	40	54.2
Keokuk	56	68	52	48	48	52	60	46	47	53	53	60	48	44	58	68	63	64	69	68	70	65	66	55	64	52	52	59	46	40	44	56.0
Keosauqua	52	68	56	48	50	50	56	40	47	52	51	61	60	44	54	67	60	63	68	68	68	62	62	55	66	54	52	59	48	40	44	55.9
Knoxville	50	64	47	49	52	50	52	47	50	51	51	59	48	45	56	64	64	66	70	66	66	62	63	54	65	54	53	50	40	40	43	54.6
La Crosse (Wis.)	48	58	46	46	45	48	50	44	46	48	46	56	44	40	51	58	50	53	64	64	62	55	54	48	54	52	48	55	46	44	42	50.0
Larrabee	46	58	44	43	47	62	50	46	50	46	48	50	40	46	55	61	52	65	60	68	58	56	51	56	52	46	53	50	33	33	38	50.3
Marshalltown	48	56	56	54	42	52	44	35	45	45	48	52	39	50	55	54	62	65	66	63	50	52	52	44	49	36	42	47	40	38	39	49.0
Mason City	54	50	46	54	38	46	..	48	42	46	46	50	40	38	40	57	48	68	62	64	62	53	48	48	56	46	46	51	36	37	40	48.7
Maxon	58	64	47	47	43	56	67	40	49	50	55	54	42	49	59	62	59	62	65	72	64	60	56	57	54	45	53	48	41	40	42	53.1
Mechanicsville	46	64	46	45	44	46	54	46	44	41	48	53	44	41	52	61	61	62	64	65	62	58	59	54	56	50	60	52	55	40	42	52.3
Monticello	51	60	44	46	42	50	51	39	41	44	48	58	39	36	58	60	52	63	58	68	58	57	52	47	53	49	48	54	43	40	38	49.5
Mt Pleasant	60	68	51	51	47	55	53	46	40	47	55	59	46	50	55	63	61	65	62	67	66	61	62	57	60	52	49	53	45	39	42	52.7
Mt. Vernon	59	60	45	47	41	54	48	42	48	48	53	55	42	46	52	61	56	61	64	70	63	61	55	54	54	50	52	57	44	41	40	52.2
Newton	48	62	32	46	47	49	51	44	45	50	49	51	46	44	58	62	60	65	66	68	63	59	57	52	61	50	50	52	43	39	43	52.8
Ogden	54	60	44	48	45	53	52	44	50	48	49	54	43	44	59	60	56	64	65	69	60	58	56	52	58	49	51	46	50	37	43	51.9
Omaha (Neb.)	53	61	46	48	50	62	46	46	51	52	56	58	50	50	62	63	62	67	66	72	63	60	60	62	64	52	59	48	34	34	43	55.0
Osage	44	58	40	44	42	48	46	36	42	40	42	46	36	38	48	52	44	55	56	64	56	52	48	46	50	42	48	49	42	40	40	46.3
Osceola	54	58	43	44	41	54	45	38	38	44	50	53	41	45	56	56	54	58	60	60	58	52	50	49	57	45	50	49	38	35	36	48.7
Oskaloosa	48	64	50	47	42	48	50	45	44	48	48	58	47	53	57	68	58	65	66	68	70	60	58	60	63	52	50	54	44	41	....	53.5
Ottumwa	59	67	48	49	45	54	50	46	50	51	54	58	44	48	60	65	58	67	64	72	64	62	59	55	60	50	54	50	42	40	44	54.6
Ovid	54	65	50	46	48	55	48	44	49	50	51	60	48	46	62	64	61	66	66	68	67	61	60	56	64	55	52	48	40	37	44	54.3
Panama	49	58	48	44	46	58	52	42	52	51	50	54	40	46	58	61	58	65	65	70	59	58	57	58	62	48	56	53	36	33	41	52 5
Richland	55	64	45	46	44	55	56	50	48	46	48	46	40	47	60	62	60	64	62	70	62	60	53	54	63	47	56	54	44	40	40	52.9
Rockwell City	50	52	42	40	41	56	38	40	48	47	50	48	42	48	56	60	54	65	64	64	56	56	50	54	51	46	51	38	34	34	38	48.9
Sac City	56	53	48	43	43	52	43	40	48	48	48	43	44	48	56	60	56	59	60	60	58	58	54	51	50	44	50	43	35	34	40	49.6
Seymour	54	66	54	46	47	55	55	44	48	50	52	60	45	46	55	70	70	68	66	70	68	60	54	67	46	50	52	52	47	57	44	55.3
Sibley	47	54	43	42	42	52	48	46	43	43	44	52	43	44	55	56	46	60	60	66	62	52	50	54	58	56	....	52	38	33	40	49.6
Sioux City	52	59	44	45	48	60	40	44	52	50	54	53	46	49	56	64	56	66	65	70	62	58	60	58	50	58	41	34	34	42	53	0
Spirit Lake	52	56	43	42	42	53	50	40	52	46	44	50	42	47	56	59	50	63	62	42	57	56	53	54	54	43	46	45	37	34	45	49.1
Unionville (Mo.)	65	68	58	56	60	63	57	48	52	52	60	60	53	58	64	65	70	70	68	64	64	60	62	65	64	64	70	53	40	43	47	59.5
Villisca	48	61	46	46	48	56	45	43	48	50	48	54	44	44	62	60	57	62	68	70	65	56	56	54	62	51	50	42	36	36	41	51.8
Vinton	51	63	44	47	40	51	48	42	48	48	50	54	40	44	56	60	51	64	62	70	59	57	53	50	54	49	52	50	42	39	38	50.8
Washington	51	65	47	46	46	48	52	45	44	50	48	58	44	42	58	63	59	64	64	68	65	59	60	53	63	50	50	56	43	40	34	52.7
Webster City	46	59	44	46	40	48	43	44	51	48	50	46	37	46	52	59	56	59	62	64	56	57	50	52	46	43	43	43	38	35	38	48.4
Waukee	50	60	52	46	46	48	53	43	48	48	50	54	48	46	55	60	66	65	64	64	60	56	55	54	60	45	52	54	43	40	43	52.2
Williams	44	57	42	44	39	51	44	41	48	43	50	53	41	47	51	57	54	58	56	64	56	57	51	54	52	42	54	43	46	36	36	48.8
Wilton Junction	48	64	48	48	44	47	46	44	52	49	46	58	44	45	56	59	56	60	62	69	62	55	55	47	58	46	54	58	46	44	41	52.0
Winterset	48	58	44	44	45	56	49	46	50	48	49	55	44	45	58	63	59	64	64	68	63	58	60	54	62	49	52	57	38	36	40	52.4

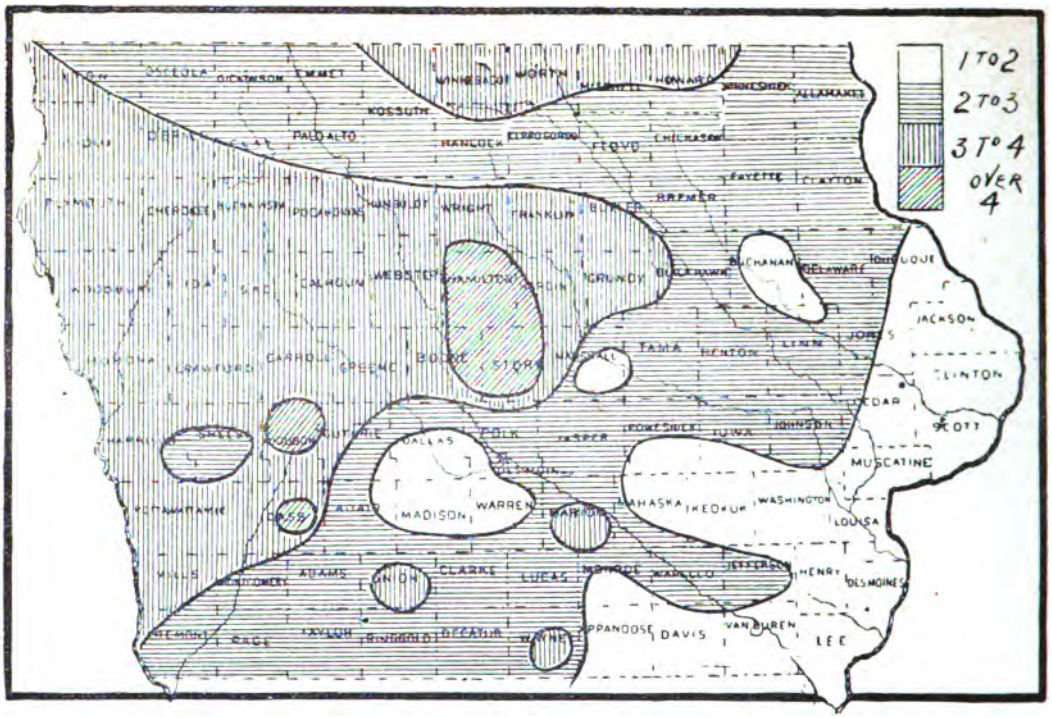
DAILY AND MONTHLY PRECIPITATION FOR OCTOBER, 1894.

STATIONS.	DATE.																															Total.
	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th	27th.	28th.	29th.	30th.	31st.	
Afton	.12	.42				.60	.50												.25		1.50							.14				3.53
Algona	.85	T	T				.02			T										1.10				.20	.40				.35			2.92
Alta	1.57	T	.03				.05													.40				.33	.02		T	.08	.60	.10		3.18
Amana	.54						.05											.13			.65				1.31	.25			.28	.06		2.27
Ames (I. A. C.)	.18	.40					.02													2.18	1.28					.25		.18	.04	.18		4.71
Ames (Experiment Station)	.58	.01					.02												.29		3.23		.02		.30	.33			.23	.10	.05		5.25
Atlantic	2.77					T																.45			.05	T			.20	.31			3.78
Atlantic (near)	2.23		T			.08	T		T										.09		T	1.88				T			.26	.18	.03	T	4 75
Audubon	2.45																			1.05						.18			.32	.10	.05		4.15
Bonaparte	.20										.13						.20			.49				.26					.25	.18			1.71
Carroll	1.83	.13					T													.64			.11		.12			.18		.28		3.29
Cedar Falls		.65																	T		1.27				.30			.65	.20			3.07
Cedar Rapids		.54		T				.05											.06		.74		.02		.23	.29			.26	.04	T	2.23
Clarinda	1.47					.08	T													.73								.25	.24			2.77
Clinton		.44				.01	.02					.10						.01	.06		.75				.09	.70		.26				1.84
Corning	1 12					.10	T							T				T		.74								T	.35			2.31
Cresco	.75		.02	.04			.13											.02	.05		1 25				.67	.35		.17	.19			3.64
Davenport	T	.38	T				.02					T			T			T	.02	.02	.27				.07	.07		.02	.15			1.02
Decorah	.80																		.50	.71					.30	.18		.19	.20			2 83
Delaware	.56						.07											.09			.97	.70			.69			.21				2.66
Des Moines	.23	.48	T			T	.04					T						.01	.31	.30	.20				.66	.12		.14	.04	.31	T	2.24
Dubuque		.42		.02			.06					.02							.03	.03	.41		.07		.13	.20		T	.12	T			1.39
Elkader	.05	.74	.03				.08											.08	.07	.15	.66	.01			.47	.35		.10	.01	.07			2.87
Emmetsburg	1.05	.25	T				.08			T										.16	.20				.17			.12	.17	T			2.20
Fairfield	T	.32	T			T	.08					.20			T			T	.20		.69					.38			.28	.16			2.31
Forest City	1.14	.08	T				.13													1.37		.04			.40			.43	T	T			3.59
Fort Madison		.29	T			T						T						.13		T					.12	.32		.59	T	.26			1.71
Glenwood		1.64	.03																		.80							.32		.86			3.65
Grand Meadow		.50		1.06			.10												.04		.96				.26	.37			.22		.06	2.87
Greenfield		.53	.74															.12		.54					T			.13	.04			2.10
Grinnell		.60					.15												.15	T	.55				.42	.08		.33	.31	.15			2.74
Grundy Center	.55		T	T			.05											.11		1.40		.05			.71	.30		.07		.07			3.37
Hampton	1.35		T															T		1.16					.69			.32	.33	.09			3.91
Hawkeye			.58		T		.15		T	T								.02		T	.95				.25	.22			.52				2.70
Hopeville	.32	.30	T			.07	.02								T			.23		.30	.73							.04	.17	.11			2.29
Humboldt	.59	.90	.05	.01			.04													.40	.70			.25	.11			.17					3.22
Independence	.50						.03												.15		.60				.30	.25			.10				1.93
Indianola		.45	T			T	T											T	.14						T			.15	T	.35			1.09
Iowa City	T	.27	T				.11											T	.05		1.04				.15	.37			.31				2.30
Keokuk		.32	T			T	T					.01			.06				.10		.07				T	.10		.42	.07	.13			1.28
Keosauqua	T		.11	T	T	T	T									T		.17		T	1.00				T	.14		.19	T	.22			1.83
Knoxville	T	.47	T															.30			1.08				.37	.37		T	.37	.08			3.04
La Crosse, Wis	T	.52	.01	.06	T		.05	T		.01							T			.31	.54	.01			.18	.01		.13	.06	.01	T		1.90
Larrabee	1.58		T				.07																		.15		.20	.16	.60				2.85
Le Claire		.31					.07					.13							.02		.49				.31	.07		.09		.07	.02		1.58
Marshalltown	.68					.05	T	T			T							.10		.64	T				.27			T	.15	T	T		1.89
Mason City	1.25		.07			.06												.04		1.35					.08	.04			.25	.13			3.86
Maxon		.35	T			T	T											T	.35		.12				.35		T	.25	.20	T	T		1,62
Monticello		.36	.01				.07												.11	.70	.73		.07		.25	.32		.19					2.11
Mt. Pleasant	T		.19				.08					.15							.23		.51					.24		.24	.13				1.77
Newton	.06	.56	T				.11											.13		.12	.43				.25	.55		.04	.36	.10	T		2.71
North McGregor		.52		.04			.06											.09	.09		.48	T			.16	.70		.13	.02				2.29
Ogden	.30	.89					.03												.15		1.98				.22			.22	.03				3.82
Omaha, Neb	1.02	.59	T				T													.02	.15							.29	.72	.05			2.94
Osage	96		.03				.10														1.33				.48	.24		.23		.01			3.38
Osceola	12	.56	T			.07	.09							T	.01			.05	.31	1.38				T				.02	.11	.14			2.86
Oskaloosa	.25		.20				.12											.15						.52						.50			1.66
Ottumwa	.02	.14	T		T		.10								.04				.26		2.20				.14	.16		.21		.16			3.33
Ovid	.61		.01				.01	.02							.16			.68			1.81							.06	T	.33			3.69
Panama	1.70																			.40								.21	.40				2.71
Richland	.16		.02			.01						.04				T		.11			.63					.19		.32		.18			1.66
Rockwell City	1.64	.06	.04	.40		.05														1.34				.19	.17		.18	.03	.10				3.80
Sac City	1.25	.10	T				T														.90				.35			.10			.50		3.10
Seymour	.60		T			T												.66		T	T							T	.50	.20			1.96
Sibley	1.27	.67	.04	.02				.18																	.15			.51	.04	.06	T		2 94
Sioux City	1.30	.66	.01				.06													.01					.21			.46	.52	.05			3.28
Spirit Lake	1.09		.23																	.12					.08			.32	.20	.12			2.16
Unionville, Mo		.25	T			.03	.11								.06			.36	T						T				T	1.23			2.04
Villisca	.68	1.35	T			.06	T											T	T									.11	.15	T			2.35
Vinton	.04	.52																.15		.63					.37	.29		.32		T	T		2.32
Washington	.23		T				.03												.15		.50					.15			.28	.20				1.56
Waukee	.10	.48	T														T	.35	.45						.15			.15	.20				1.88
Webster City	1.25						T											T		2.35				.35	.40								4 35
Williams		.94	.05				.05											.08		.80				.43	.34			.13					3.11
Wilton Junction	.33		T			T	T											T	.37	.58					T		T	.24	T				1.76
Winterset	.61					T	.05												T		.08				T	.27		.18	T	T				1.76

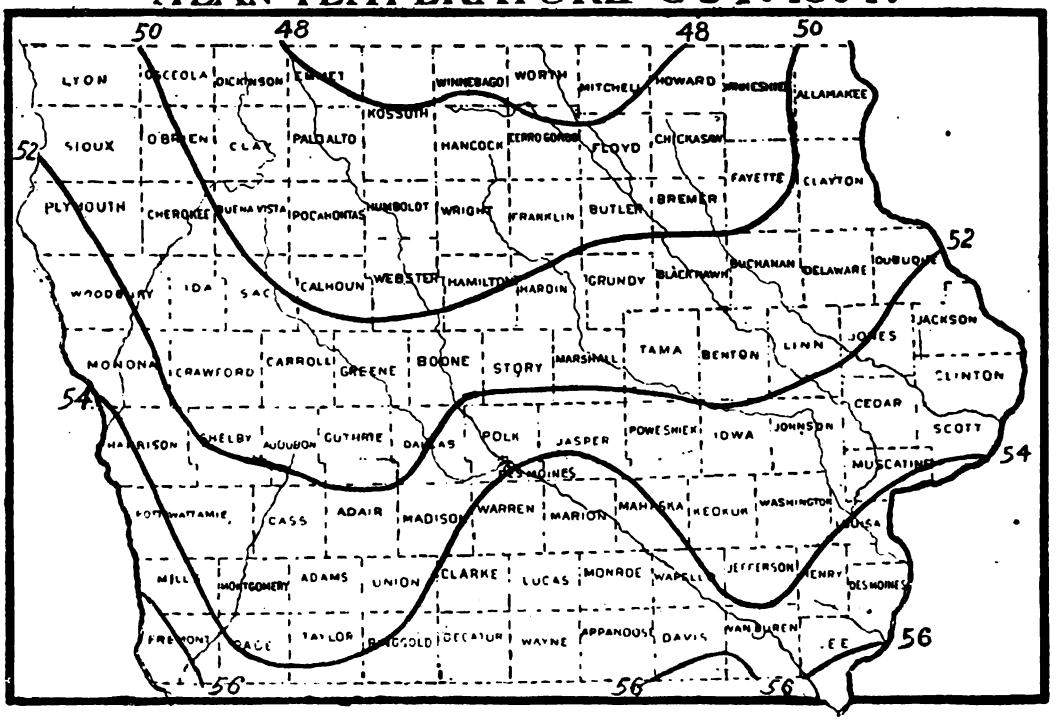
MAXIMUM AND MINIMUM TEMPERATURE FOR OCTOBER, 1894.

| STATIONS. | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | | 9 | | 10 | | 11 | | 12 | | 13 | | 14 | | 15 | | 16 | | 17 | | 18 | | 19 | | 20 | | 21 | | 22 | | 23 | | 24 | | 25 | | 26 | | 27 | | 28 | | 29 | | 30 | | 31 | | Mon'y Mean. | |
|---|---|---

PRECIPITATION CHART OCT. 1894.



MEAN TEMPERATURE OCT. 1894.



METEOROLOGICAL STATIONS AND OBSERVERS

From the following, weekly and monthly reports of Meteorological data are received by the Iowa Weather and Crop Service.

Afton	Hon. N. W. Rowell.
Albia	Carl Koontz.
Albia (Maxon)	Gus Johnson.
Algona	C. D. Pettibone.
Alta	D. E. Hadden.
Amana	Conrad Schadt.
Ames (Exp. Station)	W. H. Helleman.
Atlantic	J. W. Love.
Atlantic	Geo. W. Franklin.
Audubon	J. F. Hocker.
Bancroft	J. A. Frech.
Belle Plaine	H. W. Vandike.
Blakeville	James Rodgers.
Bonaparte	Hon. B. R. Vale.
Carroll	Moses Simon.
Cedar Falls	Prof. A. C. Page.
Cedar Rapids	H. D. Olds.
Centerville	Prof. H. E. Reister.
Charles City	J. W. Smith.
Clarinda	A. S. Van Sandt.
Clinton	Luke Roberts.
College Springs	A. A. Berry.
Corning	John W. Bixby.
Cresco	Gregory Marshall.
Council Bluffs	E. W. Hart.
Davenport	*F. J. Walz.
Delaware	Wm. Ball.
Decorah	F. H. Baker.
Denison	M. E. Lles.
Des Moines	*Geo. M. Chappel, M. D.
Dubuque	*T. W. Ruete.
Eldora	Prof. C. F. Woodward.
Elkader	Chas. Reinecke.
Emmetsburg	J. A. Carmichael.
Fairfield	Charles J. Fulton.
Fayette	R. Z. Latimer.
Ft. Madison	Miss L. A. McCready.
Forest City	J. A. Peters.
Galva	W. A. Crowley.
Glenwood	Seth Dean.
Greenfield	J. G. Culver.
Grinnell	Prof. S. J. Buck.
Grundy Center	Geo. F. Ellis.
Hampton	E. C. Grenelle.
Hawkeye	J. W. Bopp.
Hopeville	M. T. Ashley.
Hopkinton	Theo. Marks
Humboldt	H. S. Wells.
Independence	E. F. Wulfke.
Indianola	Prof. J. L. Tilton.
Iowa City	Prof. A. L. Arner.
Iowa Falls	J. B. Parmelee.
Jefferson	Dr. Chas. Enfield.
Keokuk	*Fred. Z. Gosewisch.
Keosauqua	Prof. J. H. Landes.
Knoxville	Casey and Reeves.
Larrabee	H. B. Strever.
Logan	Mrs. M. B. Stern.
Mason City	H. I. Smith.
Marshalltown	C. M. Cook.
Maquoketa	Dr. A. B. Bowen.
Mechanicsville	Rev. J. W. Hubbard.
Mooar	F. G. Thomas
Monticello	Henry D. Smith
Mount Vernon	Prof. A. Collin.
Mt. Ayr	Hon. Wm. Shriver.
Mt. Pleasant	Dr. Max E. Witte.
Muscatine	J. P. Walton.
Newton	A. Lufkin.
Ogden	E. Sayre.
Omaha, Neb	*Geo. E. Hunt.
Osceola	A. W. Lewis.
Ovid	H. C. Miller.
Osage	G. D. Pattingill.
Oskaloosa	Jos. Boyd.
Ottumwa	L. J. Baker
Panama	Wm. J. Wicks.
Postville	F. L. Williams.
Richland	Wm. A. Shaffer.
Rock Rapids	W. C. Wyckoff.
Rockwell City	G. B. Rigg.
Seymour	Mrs. C. A. Conger.
Sibley	H. G. Doolittle.
Sidney	G. V. Swearingen.
Sioux City	*U. S. Pursell.
Sac City	Dr. C. Brown.
Spirit Lake	W. C. Drummond.
Sutherland	W. H. Bloom.
Toledo	Chas. Mason.
Vinton	T. F. McCune.
Villisca	J. F. McCartney.
Washington	Wm. A. Cook.
Waukee	John Wragg
Webster City	C. M. Trumbauer.
Wilton Junction	J. M. Rider.
Winterset	Will McKnight.
West Bend	Phil. Dorweiler.
Williams	M. L. Fuller.

*U. S. Weather Bureau.

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Alta	Hon. H. T. Saberson.
Ames	Henry C. Wallace.
Anita	H. T. Chapin.
Ankeny	Ed. Parmenter.
Battle Creek	A. Preston.
Bloomfield	Geo. Duffield.
Boone	L. C. Morris.
Bristow	G. W. Wells.
Carson	G. N. Ferguson.
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Chariton	C. C. Burr.
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Corning	Jerome Smith.
Clermont	Chas. Larrabee.
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Council Bluffs	L. Prouty.
Dedham	J. A. Horton.
Danville	Sherman Matthews.
Emerson	D. B. Nims.
Ely	Hon. A. J. Fuhrmeister.
Fulton	Carl S. Frank.
Fontanelle	Hon. L. M. Kilburn.
Ford	J. C. Richards.
Fort Dodge	R. W. Blaine.
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Gosport	B. F. Banta.
Grinnell	A. O. Price.
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Hesper	G. E. Dillingham.
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Larrabee	H. H. Carnahan.
LeMars	Hon. Henry Schrooten.
Ledyard	Frank Miller.
Lawler	Hon. Wm. Glattly.
Lockridge	John F. Farman.
Manning	H. W. Pollock.
Mapleton	A. Lamb.
Marshalltown	Hon. J. G. Brown.
Mason City	Wm. Nettleton.
Mt. Pleasant	W. S. Wright.
Milton	Hon. E. C. Holland.
Mount Vernon	Robert Smith.
Newton	J. P. Beatty
North English	J. L. Williams.
Nevada	O. G. Ashford.
Osage	E. W. Stacy.
Orange City	H. J. VandeWaa.
Paton	A. B. Condit.
Pittsburg	G. C. Duffield.
Polo Station	A. E. Miller.
Prescott	G. W. Iden.
Paullina	Stephen Harris.
Rockwell City	J. G. Palmer.
Rock Rapids	D. E. F. Merrill.
Rossville	F. B. Wiley
Sandusky	Z. Hollingsworth
Sageville	Hon. F. N. Knoll.
Seymour	J. F. Wagner.
Shenandoah	Reuben Mullison.
Spirit Lake	C. E. Abbott.
State Center	E. N. Thompson.
Sumner	John Dawson.
Tama	W. G. Malin.
Unity	Edw. Hummer.
Van Horn	Spencer Smith.
Wapello	O. P. Smith.
Wheatland	D. Beckman.
Willow Creek	W. S. Nicholson.
Winterset	H. A. Kinsman.
Wall Lake	I. E. Wilcox.
Walnut	F. L. Martin.
What Cheer	O. D. Lawrence.

Met 217

UNITED STATES DEPARTMENT OF AGRICULTURE
WEATHER BUREAU.

MONTHLY REVIEW

OF THE

Iowa Weather and Crop Service.

VOL. V. —NOVEMBER, 1894.—NO. 11.

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CENTRAL STATION, DES MOINES, IOWA.

J. R. SAGE,
DIRECTOR.

GEO. M. CHAPPEL, M. D.,
LOCAL FORECAST OFFICIAL,
U. S. WEATHER BUREAU, ASS'T DIRECTOR.

DES MOINES:
G. H. RAGSDALE, STATE PRINTER.
1894.

THE IOWA WEATHER AND CROP SERVICE

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Vice-President—F. N. CHASE, Cedar Falls, Black Hawk Co.
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JOHN A. EVANS, F. N. CHASE, P. L. FOWLER.

U. S. Department of Agriculture---Weather Bureau.

MONTHLY REVIEW

OF THE

IOWA WEATHER AND CROP SERVICE.

VOL. V.] NOVEMBER, 1894. [No. 11.

DECEMBER CROP REPORT, 1894.

FINAL REPORT OF THE SEASON, SHOWING AVERAGE YIELD AND MARKET PRICES OF THE STAPLE PRODUCTS OF IOWA.

The final crop report of the exceptionally unfavorable season of 1894 makes a better showing of the aggregate products of the State than was deemed possible during the period when the drouth was at its height of severity.

CORN—Average yield on the basis of the full acreage planted, 12 bushels per acre—a little above one-third of an average crop. Acreage planted, 6,738,970 acres; total yield, 80,867,640 bushels. About 60 per cent was cut and the fodder has been generally secured in good condition; this will materially enhance the feeding value of the crop. Husking returns show more than the usual average of unmerchantable corn. Average price at nearest station, 45 cents per bushel.

WINTER WHEAT—Acreage harvested, 207,863 acres; average yield, 16.7 bushels per acre; total yield, 3,481,312 bushels; price, 51 cents.

SPRING WHEAT—Acreage harvested, 564,770 acres; average yield, 12.8 bushels per acre; total, 7,239,905 bushels; price, 48 cents. Total winter and spring wheat, 10,720,177 bushels.

Estimates of competent observers in every county in the State indicate that about two and a quarter million bushels of wheat have been fed to stock. In the opinion of the director this estimate is in excess of the correct figures.

OATS—Acreage harvested, 4,029,719 acres; average yield, 24 bushels per acre; total, 96,713,256 measured bushels, of the best quality and unusually heavy weight; price, 27 cents.

RYE—Yield per acre, 15.1 bushels; total, 1,554,650 bushels; price, 43 cents.

BARLEY—Area harvested, 501,031 acres; average yield, 18.4 bushels per acre; total, 9,218,970 bushels; price, 40 cents.

FLAX—Reports show a decrease of 18 per cent in the area of this crop, compared with last year. Area harvested, 216,436 acres; average yield, 8 bushels per acre; total, 1,731,488 bushels; price, $1.20.

TIMOTHY SEED—Yield 2½ bushels per acre. Estimated product, 376,500 bushels; price, $3.25 per bushel.

CLOVER SEED—Average, 1.6 bushels per acre; total output, 72,000 bushels; average price, $5.50.

MILLET SEED—Average per acre, 9.1 bushels; acreage unknown; price, 67 cents.

BROOM CORN—Number of tons raised (estimated) 1,200; average price, $61.70 per ton.

SORGHUM—Yield 58 gallons per acre; probable amount produced, 377 000 gallons; price per gallon, 46 cents.

IRISH POTATOES—Average yield 40.7 bushels per acre; total product, 4,709,804 bushels; market price, 66 cents per bushel.

SWEET POTATOES—Average yield 37 bushels per acre; estimated product, 110,000 bushels; price, $1.20.

BUCKWHEAT—Estimated yield, 320,000 bushels; market price, 76 cents per bushel.

HAY—Average yield, ¾ of a ton per acre; estimated product, 1,875,000 tons; price, $8.20 per ton.

PRAIRIE HAY—Estimated amount put up, 1,350,000 tons; price, $5.00 per ton.

GENERAL CROP SUMMARY—1894.

PRODUCTS.	Number of acres.	Average per acre.	Total product.	Market value.
Corn	6,738,970	12.0 bu.	80,876,640	$ 36,394,488
Wheat (winter)	207,863	16.7 bu.	3,481,312	1,775,469
Wheat (spring)	564,770	12.8 bu.	7,239,905	3,475,154
Oats	4,029,719	24.0 bu.	96,713,256	26,112,578
Rye	.....	15.1 bu.	1,554,650	668,499
Barley	501,031	18.4 bu.	9,218,970	3,687,508
Flax	216,436	8.0 bu.	1,731,488	2,077,785
Timothy seed	.....	2.5 bu.	376,500	845,125
Clover seed	.....	1.6 bu.	72,000	396,000
Broom corn	.....	.....	.....	74,000
Sorghum	.....	.....	.....	173,420
Irish potatoes	.....	40.7 bu.	4,709,804	3,104,470
Sweet potatoes	.....	37.0 bu.	110,000	132,000
Buckwheat	.....	.....	320,000	243,200
Hay	.....	4-5 ton.	*1,875,000	15,375,000
Prairie hay	.....	.....	*1,350,000	6,750,000
Pasturage (estimated)	.....	.....	.....	20,000,000
Total value	.....	.....	.....	$ 121,284,696

*Tons.

In the above summary of soil products and their market value, no account is made of the products of orchards, vineyards and gardens, amounting to a considerable sum. Pasturage is estimated and it is believed to be below rather than above the actual value. The estimated total value of soil products in 1893 was about $200,000 000. The output of the soil this year is believed to be about $121,000,000.

AVERAGE YIELD PER ACRE BY COUNTIES.

COUNTIES.	Winter wheat, bu.	Spring wheat, bu.	Corn, bu.	Oats, bu.	Rye, bu.	Barley, bu.	Flax, bu.	Timothy seed, bu.	Clover seed, bu.	Millet seed, bu.	Broom corn, tons.	Sorghum, gallons.	Irish potatoes, bu.	Sweet potatoes, bu.	Buckwheat, bu.	Tame hay, tons.
Adair	14	12	6	18	12	...	8	1.7	2.0	15	...	54	28	...	...	0.4
Adams	20	15	14	30	27	15	6	2.0	1.5	0	...	50	16	15	...	0.6
Allamakee	14	10	16	30	25	21	2	4.0	1.3	....	...	100	37	...	7	1.3
Appanoose	16	...	12	20	13	...	...	2.2	2.5	....	...	105	44	90	30	0.6
Audubon	12	12	6	13	11	7	....	...	1.6	1	...	75	43	.....	...	0.4
Benton	16	12	12	28	13	18	8	3.0	1.5	....	...	50	68	.....	....	0.6
Black Hawk	...	....	11	23	12	21	10	3.3	1.5	0	0	51	40	27	6	1.0
Boone	10	12	13	21	14	...	5	2.5	2.0	10	...	69	28	40	10	0.5
Bremer	....	....	8	22	19	....	....	3.5	....	....	...	50	30	.....	10	0.8
Buchanan	....	....	10	30	16	....	7	5.0	....	....	...	42	46	.....	14	1.0
Buena Vista	....	12	9	19	11	12	9	2.0	....	....	...	....	39	.....	20	0.5
Butler	....	11	12	20	15	20	7	2.7	0.2	12	....	52	42	40	7	0.6
Calhoun	....	11	8	16	15	16	6.3	2.0	....	17	....	46	34	15	12	0.4
Carroll	11	11	6	11	11	13	2.5	1.5	1.2	7	0.5	33	19	25	2	0.3
Cass	15	14	9	18	17	11	....	0.5	0.7	....	....	23	53	.....	....	0.3
Cedar	21	15	22	34	16	20	....	4.3	1.6	....	....	50	47	.....	10	1.2
Cerro Gordo	..	11	15	28	15	21	9	2.3	1.5	4	....	80	44	..	12	1.1
Cherokee	....	15	15	25	20	15	8	2.5	1.5	10	....	....	52	.....	10	0.7
Chickasaw	...	15	12	32	15	25	11	3.0	....	....	....	58	46	.....	13	1.0
Clarke	15	12	10	18	13	20	....	1.7	1.2	0	....	45	15	25	....	0.2
Clay	..	14	12	22	15	18	4	3.0	....	....	0.8	30	29	.....	....	0.8
Clayton	18	10	15	37	15	21	..	3.0	1.7	....	....	50	45	.....	12	1.5
Clinton	....	15	15	30	....	....	....	....	....	....	....	....	100	.....	....	1.5
Crawford	..	11	6	16	14	8	5	1.0	0.5	10	....	8	41	4	6	0.5
Dallas	18	13	10	19	14	....	....	1.8	1.3	13	1.0	37	22	25	19	0.6
Davis	16	....	15	24	11	....	....	3.2	....	....	....	47	51	102	....	0.8
Decatur	17	11	10	22	15	....	3	2.0	1.0	5	....	43	22	39	10	0.4
Delaware	16	15	11	29	18	24	....	4.2	0.9	6	....	10	54	.....	13	0.8
Des Moines	19	8	21	32	14	....	....	3.0	2.9	....	....	110	58	85	....	1.2
Dickinson	..	14	15	22	....	16	3.7	4.0	....	....	....	....	33	.....	....	0.8
Dubuque	15	13	20	24	15	26	....	3.5	2.0	10	....	....	25	.....	11	1.9
Emmet	..	12	20	20	10	15	4	5.0	2.0	5	....	40	20	.....	8	1.0
Fayette	18	12	12	30	18	23	9	4.0	1.6	12	....	3	47	.....	8	1.1
Floyd	12	11	14	28	19	21	8	3.0	1.5	6.5	0.5	7	47	.....	17	0.8
Franklin	..	16	20	28	..	18	11	2.0	0.7	5	..	22	54	.....	20	0.7
Fremont	23	11	8	24	19	....	....	....	2.0	....	....	50	27	56	....	0.6
Greene	15	14	8	19	14	....	5	0.0	0.0	0.0	....	35	39	100	8	0.5
Grundy	...	13	9	17	14	21	5	3.0	1.4	....	....	....	42	.....	13	0.6
Guthrie	13	11	6	13	15	7	7	0.1	0.5	6	....	50	7	25	....	0.2
Hamilton	....	9	11	18	15	....	5	....	....	....	....	75	20	.....	....	0.4
Hancock	....	15	19	33	19	23	8	2.9	....	0.0	....	75	17	.....	2.5	0.7
Hardin	12	15	15	22	16	16	8	2.2	1.5	10	0.5	68	33	6	14.0	0.6
Harrison	20	14	9	22	13	15	....	....	....	19	....	....	26	.....	....	0.4
Henry	18	12	20	36	19	....	....	2.6	2.0	....	....	40	41	25	....	1.2
Howard	13	13	14	33	11	22	11	3.2	1.0	....	....	60	13	.....	10	0.9
Humboldt	....	16	16	28	14	20	8	2	....	5	0.3	62	32	.....	10	0.6
Ida	....	11	6	17	16	6	....	0.0	0.4	9	....	....	19	25	....	0.3
Iowa	17	13	16	23	16	18	....	5.0	2.1	6	2.5	50	36	16	14	1.5
Jackson	13	16	24	35	20	23	....	5.0	2.0	7	....	70	65	.....	25	1.5
Jasper	18	12	13	20	17	15	....	2.2	1.3	5	1.2	69	56	52	15	0.4
Jefferson	15	10	19	26	16	11	....	2.6	1.6	14	0.2	65	47	72	15	1.0
Johnson	22	18	20	39	20	30	....	4.2	2.3	....	....	130	61	100	....	1.2
Jones	....	16	21	37	19	32	....	4.0	4	....	....	80	57	.....	10	1.1
Keokuk	17	12	21	29	18	....	....	3.2	1.9	....	....	60	40	100	....	1.0
Kossuth	....	20	20	40	..	30	8	....	....	....	....	40	..	.....	....	1.0
Lee	17	....	16	29	13	....	....	3.4	1.7	3.0	1.0	45	43	48	8	0.9
Linn	17	12	19	31	16	22	....	5.0	2.0	....	1.7	90	38	.....	....	1.1
Louisa	18	13	17	29	15	....	....	2.0	1.1	....	....	56	31	70	25	0.0
Lucas	16	....	9	18	14	7	...	1.2	0.5	10	0.2	47	22	32	....	0.2
Lyon	....	10	12	14	11	11	6	3.0	..	15	....	....	62	.....	....	0.7

TABLE SHOWING AVERAGE PRICE OF CROPS, ETC.

COUNTIES.	Winter wheat, bu.	Spring wheat, bu.	Corn, bu.	Oats, bu.	Rye, bu.	Barley, bu.	Flax, bu.	Timothy seed, bu.	Clover seed, bu.	Millet seed.	Broom corn, ton.	Sorghum, gallon.	Irish potatoes, bu.	Sweet potatoes, bu.	Buckwheat, bu.	Tame hay, ton.	Wool, pound.	Cows, per head.	Horses.
Adair	$ .50	$ .46	$ .55	$ .28	$ .43	$ .32	$ 1.25	$ 1.65	$ 5 75	$ .50	$	$ .46	$ .69	$	$	$ 8.12	$ .11	$23.00	$35 00
Adams	....	.48	.42	.48	.27	.32	.25	.80	1.50	5.25	....	.50	.60	.50	.....	9.33	.13	22.00	36.00
Allamakee	....	.48	.45	.41	.25	.41	.45	....	2.13	5.08	....	.40	.47	....	.68	6.75	.11	22.00	35.00
Appanoose	....	....	....	.47	.31	.50	....	....	2.08	4.50	....	.42	.66	.63	.50	9.16	.11	21.00	32.00
Audubon	....	.59	.49	.29	.65	.42	.....	....	1.50	6.25	....	.45	.76	1.50	....	8 00	.03	18.00	28.00
Benton	....	.46	.48	.24	.44	.40	1.00	2 00	5.27	....	....	.40	.64	....	.....	8.25	.15	21.00	35.00
Black Hawk	....	.55	.48	.26	.55	.44	1.00	2.07	6.25	....	....	.45	.68	1.10	.80	10 00	.10	27.00	39.00
Boone	....	.48	.46	.42	.26	.51	....	1.00	2.09	6.00	.63	....	.46	.74	1.00	.82	8.62	.14	22.00	42.00
Bremer	....	.58	.58	.52	.25	.47	....	1.00	2 00	6.00	.60	....	.55	.6	....	.50	9 00	.10	23.00	30.00
Buchanan	....	.55	.56	.48	.26	.51	..	1.10	1.90	5.50	....	....	.40	.6	....	.60	5.66	.11	25.00	32.00
Buena Vista	....	.50	.45	.41	.26	.47	.43	1.23	2.22	....	.80	....	.50	.5	....	.52	7.50	....	20 00	33.00
Butler	....	.54	.45	.26	.46	.40	1.03	1.90	7.25	.66	....	.34	.6	1.50	.90	9.16	.10	24 00	41.00
Calhoun	....	.49	.46	.25	.48	.42	1 20	2.19	6.00	.62	....	.47	.74	1.00	.50	8.10	.12	19.00	35 00
Carroll	....	.53	.51	.27	.56	.39	1.35	4.00	7 33	..	....	.52	.7	1.50	1.00	8.75	.14	17.00	45.00
Cass	....	.48	.46	.26	.37	.40	....	2.00	6.25	.50	....	.50	.4	....	....	9.33	.07	24 00	45.00
Cedar	....	.46	.45	.41	.27	.41	.37	....	2 28	5.30	....	.50	.6	1.00	.60	6.90	.13	27.00	40.00
Cerro Gordo	....	.55	.40	.25	.41	.35	1.24	1.58	5.50	.80	....	.40	.6	....	.75	6.80	.13	21.00	42.00
Cherokee	....	.46	.40	.25	.45	.37	1.30	2.25	6.50	.47	....	....	.6	....	.50	8.00	.12	25 00	34.00
Chickasaw	....	.52	.46	.24	.53	.42	1 20	2 08	7.00	....	....	.43	.6	....	.63	6.40	.12	23.00	37.00
Clarke	....	.44	.40	.49	.28	.55	....	2 23	5.75	.80	....	.44	.7	1.75	....	11.87	.12	23.00	29.00
Clay	....	.45	.34	.24	.41	.37	1.66	1.87	5.00	.75	75.00	.55	.75	....	.....	4.86	.12	20 00	40.00
Clayton	....	.46	.40	.45	.28	.41	.37	....	2.20	5.00	..	....	.50	.60	....	.75	7 00	.10	22.00	40.00
Clinton	....	....	.55	.50	.28	....	....	....	....	....	....	....	....	.80	....	....	8.00	....	30.00	50.00
Crawford	....	.52	.52	.29	.46	.40	.80	2.60	6.50	.30	....	.50	.80	2 00	1.50	6.00	.10	16.00	32 00
Dallas	....	.59	.52	.45	.27	.56	....	....	2.83	6.75	.42	....	.47	.64	1.50	.70	8.86	.14	24.00	47.00
Davis	....	.46	....	.46	.26	.49	....	....	1.91	5.00	....	....	.39	.71	1.14	....	7.86	.11	23.00	38.00
Decatur	....	.54	.51	.50	.31	.54	.40	1.15	1.96	4.17	.50	....	.42	.80	1.22	.50	8.71	.12	19.00	31.00
Delaware	....	.54	.55	.52	.27	.55	.41	....	2.12	6.00	.50	....	.42	.74	....	.67	7.25	.12	24.00	39.00
Des Moines	....	.45	.40	.40	.28	.69	....	....	2.33	4.33	.75	....	.50	.79	.68	....	9.00	.10	23.00	37.00
Dickinson	....	....	.45	.39	.24	....	.48	1.20	2.03	....	....	.50	.75	.75	....	....	5.16	.09	19 00	43.00
Dubuque	....	.47	.47	.47	.33	.42	.46	1.40	3.25	5.00	.65	65 00	....	.65	....	.67	11.00	....	20 00	45.00
Emmet	....	....	.43	.35	.25	....	.33	1.25	....	....	....	.50	.75	....	.....	....	5.00	.12	20 00	35.00
Fayette	....	.67	.55	.48	.26	.39	.40	.90	2 10	5.25	.60	....	.45	.76	....	.80	6.66	.11	22.00	38.00
Floyd	....	.48	.45	.41	.27	.39	.39	1.15	2 18	5.66	.80	40.00	.46	.55	....	.58	6 50	.11	24.00	33.00
Franklin	....	.50	.39	.25	....	.40	1.20	2.25	5.00	....	....	.45	.69	....	.....	....	6.50	.11	23.00	37.00
Fremont	....	.52	.48	.49	.35	.58	....	....	....	6.00	....	....	.40	.80	1.01	....	7.60	.15	30 00	43.00
Greene	....	.55	.57	.44	.27	.45	....	1.19	....	....	....	.45	.71	1.00	....	....	7.43	.12	23.00	37.00
Grundy	....	....	.58	.46	.25	.58	.45	....	7.50	6.42	....	....	.50	.51	....	.75	8 80	.10	23.00	37.00
Guthrie	....	.49	.48	.43	.30	.35	.40	1.00	2.33	5.73	.50	....	.44	.67	1.00	....	9.70	.12	17.00	31.00
Hamilton	....	....	.43	.44	.25	....	....	1.25	....	....	....	....	.50	.68	....	....	8 80	.11	17.00	39.00
Hancock	....	.46	.39	.25	.41	.41	1.27	2.04	....	....	....	.50	.66	....	.50	5.75	.10	23 00	46.00
Hardin	....	.55	.47	.41	.25	.50	.42	1.12	2.00	4.50	1 50	20 00	.45	.77	....	.81	6.88	.12	20 00	38 00
Harrison	....	.50	.45	.40	.27	.50	.45	....	....	....	.60	....	....	.90	....	....	9 00	.25	17 00	38 00
Henry	....	.49	.42	.43	.28	.40	....	....	2.04	4.40	..	....	.46	.76	.70	....	7.70	.10	25.00	39.00
Howard	....	.50	.49	.45	.25	.39	.39	1.22	2 53	5.25	....	....	.40	.68	....	.67	7.00	.12	23 00	37.00
Humboldt	....	....	.45	.40	.27	.37	.38	1.26	2.20	5.00	.75	35.00	.46	.70	....	.40	7.60	.09	20.00	36.00
Ida	....	.54	.47	.27	.45	.40	....	....	....	6.00	....	....	.50	.86	2.00	....	9.20	.11	20 00	40 00
Iowa	....	.52	.49	.41	.29	.40	.38	....	2.08	5.00	.90	....	.50	.63	2.00	.64	7.73	.06	23.00	40.00
Jackson	....	.50	.40	.47	.28	.41	.50	....	2.37	5.50	.40	....	.50	.75	....	.75	9 00	.13	22.00	45.00
Jasper	....	.55	.52	.46	.25	.43	.43	....	2 89	6.33	.75	50.00	.51	.46	1.01	....	9.00	.12	20.00	31.00
Jefferson	....	.49	.45	.43	.27	.44	.37	....	2.09	4.70	.30	90.00	.41	.73	1.08	.40	7.66	.12	24.00	34.00
Johnson	....	.46	.50	.39	.27	.40	.30	....	2 09	4.00	....	....	.37	.61	.75	....	9.00	.12	26 00	40.00
Jones	....	.56	.56	.51	.30	.50	.43	....	2.50	7.25	....	....	.33	.67	....	.75	8.00	.12	26.00	45.00
Keokuk	....	.49	.46	.43	.26	.42	....	....	2.21	5.15	....	....	.42	.70	1.45	....	7.66	.13	21.00	38.00
Kossuth	....	.49	.45	.35	.23	....	.35	1.20	....	....	....	....	....	6 00	....	....	6 00	....	25.00	35 00
Lee	....	.47	.44	.28	.42	....	....	....	2.13	4.42	.75	50.00	.47	.74	.81	.50	9.22	.14	23 00	38.00
Linn	....	.48	.50	.46	.26	.41	.42	....	1.83	5.25	....	60.00	.45	.59	....	....	7.83	.13	22.00	44.00
Louisa	....	.48	.45	.41	.26	.43	....	....	2.44	5.83	....	....	.43	.71	.87	.40	8.00	.11	24.00	40.00
Lucas	....	.56	....	.49	.29	.51	.50	....	2.36	6.50	1.00	....	.48	.72	1.00	....	11.50	.11	18.00	30.00
Lyon	....	....	.48	.40	.34	.40	.38	1.28	....	....	.40	....	.71	....	....	....	7.25	.09	21.00	37.00

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WHY IT RAINS.*

BY A. G. LUCAS, OF THE HOMESTEAD.

As a matter of venerable jest, time-worn at least, if not time-honored, the connection between adequate water supply and successful dairying has been very intimate, and the dairyman's pump handle is probably one of the most ancient jokes that has descended to us; as a matter of vital and serious earnest, the thousands of dairymen who this year saw the pastures fail, the milk flow dwindle and the butter yield approach the vanishing point can bear witness to the closeness of the connection between water in abundance and success in dairy management. "Why it Rains," is therefore no unsuitable topic, it has seemed to me, for discussion in an assemblage such as this, and the aspect of the question which I have ventured to hope might be received with some degree of interest, is the dynamics of precipitation, or the forces of nature involved in the phenomenon. While there is, as I verily believe, no way except nature's own way to make rain, the need for it in times of scarcity is so keenly felt that efforts to make it by human means or human intervention are almost as old as the need. Leaving out of question those devout clergymen who in a former day, when faith in special interpositions was livelier than at present, sought to bring about much-needed precipitation by means of prayer, the rain-maker's profession has always had practitioners, the methods varying with the character of the people among whom they practiced. In India there are officers whose business it is to see that there is enough rain to grow crops. During seasons when the rain-fall is sufficient these officers have a very good time of it, living on the fat of the land in the enjoyment of a comfortable stipend, but in seasons of drouth their lot is not a happy one, for they are taken out and soundly whipped from day to day and every day until the rain comes. Our own aboriginal tribes have their medicine men, a branch of whose duty it is to make rain by means of spells, charms and incantations, and among those of Africa, mumbo-jumbo rain-making is a regularly established industry. In this country, too, in recent years, we have had our rain-makers, who, as science is a sort of a superstition with many of us, endeavor to influence engagements by giving a kind of pseudo-scientific twist to their conjurings. It has often occurred to me, when reading of their practices upon the credulity of a drouth-stricken locality, that it would be no bad plan to introduce the system in vogue in India, and that a good sound thrashing every day until it rained would do them a world of good, even if it did not help to bring rain.

The process by which nature makes rain is a simple one, and yet when understood, it is readily seen that it is quite impossible to produce rain artificially unless one has at his command the gigantic forces which nature employs and could wield them on the same magnificent scale. The simplest illustration of the process is furnished by a steam engine in operation. Heat vaporizes the water in the boiler; the vapor is projected through the escape pipe into the air; contact with the air extracts the heat and the vapor resumes its liquid form and falls to the ground in drops. Every shower is analogous to this condensation of steam. In the boiler the water boils to become vapor; but this is not necessary, for it may vaporize at any temperature, even in winter. Still, to evaporate water requires a very large amount of heat, but it is of the kind called latent heat; it is not sensible heat; the vapor is no warmer to the senses than the water that made it, yet it is there in large amounts. How large may be inferred from the fact that with a given application of heat constantly maintained, it takes more than five times as long to vaporize water as it does to boil it, starting at 32 degrees. A given amount of water at 32 degrees must rise to 212 degrees to boil, an increase of 180 degrees; over the same flame it will take more than five times as much heat, or to be precise, 966.6 degrees, in order to evaporate. All above 212 degrees is latent; that is, it never rises above boiling point, but it has absorbed the heat just the same, and it must give it up again before it can be transformed into water and descend as rain. The same absorption of heat takes place in evaporation without boiling. The heat that is absorbed is latent, but it is absorbed. This is proved in many ways. Place the bulb of a thermometer in water that has stood in the air long enough to be of the same temperature and the mercury will stand where it did in the air, but take it out of the water and the column at once begins to fall, and the faster it dries—that is the less moisture there is in the air—the lower it falls. The evaporation of the water abstracts heat. A common method of procuring cool drinking water in hot countries affords another illustration. If the water be placed in a vessel, the outside of which is kept wet, the water within the vessel will be cooled by the absorption of heat resulting from the evaporation outside of the vessel. How much the temperature within will fall depends on the amount of humidity there is in the atmosphere—that is, how rapidly the evaporation goes on. During the past summer when there was so little humidity that there was never any dew, water could have been cooled very greatly by this method. Ice-making machines, which freeze water by means of rapidly vaporizing chemicals, afford another illustration of the absorbtion of heat which attends evaporation.

The force of the fact that evaporation requires the absorption of an immense amount of heat, and its connection with the phenomenon of rainfall, lies in this, that before the vapor can be condensed and descend as rain, it must part with the heat that has made it vapor. To make the atmosphere containing the vapor give up the heat is the problem that confronts the artificial rain maker. He must subtract from the vapor nearly five and a half times as much heat, sensible and latent, as it would take to boil the water. Reducing this statement to the test of actual figures, for every inch of rainfall on each acre, there must be subtracted enough heat to boil 620 tons of water. Results of such magnitude are possible in the great laboratory of nature, but by no artificial means yet devised can they be attained.

The cooling necessary to produce rain varies with the amount of moisture in the atmosphere. The amount of

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moisture that the air *may* contain has a max n "m mit which varies with the temperature; the amount that it actually does contain at any given time is generally below the maximum or saturation point and usually very considerably below it. At 50 degrees a cubic foot of air *may* contain a shade over 4 grains of water; at 60 degrees about 5¾ grains; at 70 degrees nearly 8 grains, and at 80 degrees about 11 grains. In other words, air at 80 degrees may contain nearly twice as much water as it can hold at 60 degrees. In point of fact it almost never reaches saturation point, but the variable limit has a connection with the rain problem. If temperature were at 80 and the atmosphere were filled with humidity to its limit, and if now the air should be cooled to 60, it must at once give up nearly half the water it contains, for at 60 it can hold in suspension about half as much as at 80. On the other hand, if the temperature were at 80, and the humidity was such that the air contained only 5¾ grains per cubic foot or less, a fall to 60 would not produce rain at all. To illustrate: If a sponge be filled with all the water it will hold, only a very slight pressure is necessary to make it part with a portion of its contained moisture; but if then the sponge be permitted to spring back to its original form it will take a stronger pressure than that first applied to make it part with any more water; when clothes have been wrung as dry as possible by hand, the housewife can still make them dryer by passing them through a wringer. Rainfall, therefore, depends upon two capital facts, a lowering of the temperature of the air, which may be compared to the squeezing of the sponge, and the amount of humidity in the atmosphere, which corresponds to the quantity of water in the sponge that is squeezed. If the humidity be such as is beyond the limit of the air at its new temperature to contain it, then it must give up a part and rain will fall; if not, not. If the atmosphere be humid the rain will occur with a slighter "squeeze;" if on the other hand the atmosphere be quite dry, a fall in temperature that would otherwise produce rain, will be without effect.

Recurring by way of illustration to the drouth of the past season, we find the atmosphere characterized by an abnormal lack of humidity. Water applied to grass plots and lawns disappeared almost as soon as it fell, sucked up by dry parched air. There was no dew. Now dew is the simplest form of rainfall, caused by the cooling of the earth and especially of the vegetation on the earth, after the sun's rays cease to operate. Grasses and foliage cool much more rapidly than the soil, and we therefore see heavy dews on vegetation when there are no signs of it on the bare ground or in the roads. The same effect is often seen on a pitcher of ice water. In common parlance we say that the pitcher "sweats." In point of fact it does not sweat at all, for sweating is from within. What it really does is to cool the atmosphere that comes in contact with it down to the dew point—that is, to a point below the capacity of the air to retain all the moisture it contains; it must then give up a part of it, which is condensed on the sides of the pitcher; sometimes there is no "sweat." because the atmosphere is very dry; at others there is a great deal, because it is very humid. During the past summer there were many times when the temperature fell sufficiently to produce rain under ordinary conditions as to humidity, but humidity being exceptionally low, there was no condensation and neither dew nor rain. The arid regions are arid not because temperature does not at times fall sufficiently to produce rain under ordinary condition, but because the winds that blow are habitually squeezed dry before they get there, and the lack of humidity render the lowering of the temperature inoperative. Whatever of effect forests, bodies of water or the practice of irrigation may have on rainfall—a question which does not fall within my present purpose—is due to local increase of humidity; in so far as these conditions fail in effect it is owing to the fact that their influence is only local and do not control the amount of moisture contained in the prevailing winds. "Whatever goes up must come down," as the schoolboys used to say by way of warning when they threw stones into the air, and this is true of the water that rises by evaporation. The quantity of moisture evaporated throughout the whole world must be equivalent to the total precipitation; otherwise there would be a steady increase or decrease of water on the globe, instead of the practical equilibrium which in fact exists, but the local variations and irregularities in its distribution are very great. It is not my purpose to consider the currents and conditions upon which these irregularities depend, even were I competent to do so, which I certainly am not. My only design is to express a layman's idea, in popular, non-scientific language, of the phenomena of evaporation and condensation involved in rainfall, with a view of conveying some conception of the magnitude of the forces necessarily operating in the production of even the smallest shower. As men are not yet omnipotent and can not yet call these vast forces into action, it follows that it is vain for them to seek to make rain.

A word as to how nature does its cooling work, and I have done. Rain is rarely caused by the meeting of two currents of different temperature, which mingle until a mean is established between them, cool enough to cause precipitation. This might often occur if warm currents were full to saturation, but they rarely, if ever, are. The cooling, which is chiefly concerned in producing rain, is of the kind known as dynamic cooling, and is due to the rising of the air cooled. This may be caused by relatively heavier air crowding or lifting it up; or it may be that a horizontal current of great force in passing over the earth encounters a mountain and is forced up the incline; or, again, it may be because a part of the atmospheric envelope of the earth is, at a particular place, brushed aside so that there the envelope is thinner, and the pressure at that point lessened. In any of these cases the rising air cools as it rises, and in proportion to the height to which it rises. For dry air this cooling is theoretically at the rate of 1 degree for each 180.5 feet, and for moist air a little less, although practically the rate is modified by other conditions to a considerable extent. Why does it cool as it rises? As is well known, the atmosphere is, roughly speaking, about forty-five miles in thickness, and has weight. Its weight is such that the pressure of the

column at the earth's surface is about fifteen pounds per square inch; 1,000 feet above the surface it is about a half pound less; at 2,000 feet above the surface it is nearly a pound less. Air, as we know it, is therefore a gas under pressure; as it rises the pressure is removed and the air expands; in doing so it performs work, both internal and external—the external work being the pushing of other air out of its way; the internal, that involved in its own expansion. Now it is a fixed principle in nature that nothing can be made out of nothing—that for every exertion of force or power something must be consumed or transformed into that power. The thing thus transformed in this instance, is the heat absorbed by the water in the process of evaporation. When a sufficient amount of it has been so transformed into work to reduce the temperature of the mass so that it can no longer retain the moisture it contained, the moisture, or such part of it as cannot be retained at the new temperature, ceases to be vapor and becomes water; it then falls to the ground in obedience to the law of gravitation.

This, in broad, general outline, and without any fullness of detail for which much more extensive treatment would be necessary, is why it rains. Evaporation and condensation alternating, each the result of forces utterly beyond any human agency. When for the formation of vapor sufficient for one inch of rainfall over an acre, heat enough to boil 620 tons of water is necessary, then as action and reaction are equal, for the condensation of vapor there must be exerted a force equally potent. As the force necessary for evaporation on such a scale of vastness exists only in nature, so, the forces for corresponding condensation exists only in nature, and rain-making by artificial means is a delusion.

THE DROUTH PROBLEM.*

Arid Seasons in Ancient Times.—Effects of Drainage and Cultivation.—Theories Discussed. Why it Does Not Rain.

BY J. R. SAGE, DIRECTOR I. W. C. S.

A question most vitally affecting the dairy industry is that relating to the permanence of the climatic conditions which have given Iowa its foremost place among agricultural States. Confidence is the basis of all business activity. We know what the past has brought forth, but what of the future? Are drouthy summers and hot winds to be the rule, instead of exceptions, in the years to come?

The dairy interest, more than any other branch of agriculture, is directly affected by the answer to these inquries. We can raise fair crops of small grain and corn with our minimum of moisture in mid-summer; but for an abundant supply of hay and pasturage we must have ample spring rains and frequent summer showers. Corn is a sub-tropical plant, which with wise culture will thrive fairly well in arid conditions; but grass is at its best only in the temperate zone, in the regions where the clouds furnish all necessary irrigation. And grass is a prime factor in dairying on a large scale.

Perhaps some of you may be surprised by the statement that, during the past ten or fifteen years, the grass crop (hay and pasturage) has brought larger net returns to the farmers of Iowa than the vast crops of corn and oats combined. In saying this it should be explained that about thirty-seven per cent of the corn crop has been wasted by not harvesting the stover. This statement emphasizes the need of ample summer moisture, which is essential to the production of grass.

The grass crop suffered most serious damage by the great drouth of the past summer. The output of hay was cut short over 50 per cent, and the pastures were rendered practically worthless for grazing for a period of nearly three months. To a large extent the roots were destroyed by the intense heat and close grazing of the hungry stock. There was a general failure of streams, reservoirs and wells, and dairymen were obliged to skirmish around at a lively rate to provide water as well as forage for their suffering herds.

The unusual experience of the past season has stimulated public interest in some of the problems of meteorology, and people are making the discovery that the tables and records of the weather clerks are not merely dry figures after all, nor wholly devoid of value to practical people. The drouthy season cut short the products of the farms, but we have grown a large crop of interrogation points, and a great variety of theories, speculations and weather prognostications for the years to come—some wise, but many otherwise.

Now it's a good thing to quicken inquiry and investigation, but it is still better to obtain correct answers. An interrogation point is somewhat like a cork-screw, which may serve to uncork healing balm or deadly poison.

A current inquiry for the past year or two has been, "Can we make it rain?" and in the drouth-stricken regions thousands of dollars have been paid to professional rain-makers to settle the question, resulting in the conclusion that their prescriptions fail to operate in an extremely dry season.

Another class of inquirers, who take no stock in the operations of rain-fakirs, have anxiously asked, "Wherefore this extraordinary shortage of rain?"—"What's the matter with our climate?"—"Is this aridity of earth and air the result of drainage and cultivation?" These are some of the questions asked by honest and intelligent men; and I regret to add that a considerable number have accepted the pessimistic theory that to a large extent our recent drouths have been produced by human agency—that is, by drainage and cultivation.

Now, if this theory is true, we may as well prepare to join the caravan of drouth-stricken settlers from trans-Missouri regions, who are moving eastward to live with their wives' relations. We shall certainly not be able to support our present and prospective population if it is true that cultivation of the soil is steadily converting this garden of the continent into a barren desert. But we would suggest that those who are contemplating moving out on this account had better get an early start wh

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roads are good, for if they tarry long the highways may relapse into their normal state of wetness and impassability.

A few years ago the opposite theory obtained wide acceptance, and boomers of western lands stoutly maintained that the advance of settlements and cultivation had brought an increased amount of rainfall along the railroads and over the semi-arid plains. This widely disseminated theory was carefully investigated by scientists, who were reluctantly forced to render the Scotch verdict, "Not proven." But the proposition that cultivation of the soil for the production of crops increases evaporation, humidity and rainfall can be sustained by a much stronger array of facts and arguments than the opposite theory.

The truth is, however, there is no substantial basis of fact to sustain the current notion that either rain storms or drouths are in any measure caused by human agency. A thorough study of the laws that govern storm movements will serve to convince the thoughtful student that the gigantic forces of nature brought into exercise in the production of the smallest shower are infinitely above the grasp of finite man.

Without going into the purely scientific field, a few salient points may suffice to allay the fears of those who have been worried by the problem of the recent drouth, whether or not we have ruined our climate by draining our bogs and plowing under the wild grasses of the prairies.

To those who are troubled by the pessimistic weather theory we may apply the words of the biblical preacher, "Say not thou, 'What is the cause that the former days were better than these?' for thou dost not inquire wisely concerning this." Those who ask why the climatic conditions were so much more favorable in former than in latter years do not inquire wisely concerning that matter. The shortage is mainly in their remembrance, or in their knowledge of weather conditions covering a sufficient period to serve as the basis for a just conclusion. This year the average total rainfall for the state in the four crop growing months—May, June, July and August—was only 6.75 inches. This notable deficiency in moisture is cited as positive proof that the state is drying up. But in 1892, during the corresponding four months, the total rainfall for Iowa amounted to 21.49 inches—an average of 5 37 inches per month. That was only two years ago—surely our theorists ought to remember the immense and damaging floods of that season. Are we to infer that our tile ditches were not in working order that summer?

There had been a great deal of ditching done prior to 1881, and yet in that year the total rainfall at Des Moines was 56.81 inches, of which amount 26.65 inches fell in the three summer months. In 1882 the summer rainfall at Des Moines was 20.08 inches; in 1885, 16 68 inches; and in 1886 only 2.58 inches.

These figures show great variability, but there is nothing in the records to show that in recent years there is a marked decrease in the quantity of rainfall. In fact, the past five years gave us more rain than the next preceding five years; and the total precipitation for the past twenty years, from 1874 to 1894, is fully equal to the amount that fell in the two preceding decades.

The Des Moines *Register* recently published a letter from the Hon. Chas. W. Irish, formerly an Iowa surveyor, and now chief of the Irrigation Commission at Washington, D. C., in which is given some interesting details of the dry summer of 1846 Judging by his description that season exceeded in severity the so-called unprecedented drouth of 1894. Mr. Irish says:

"I recollect very well the dry season of 1846, which took all of the surface water of Iowa away, so far as I knew it. The surface at the time was devoid of water to such an extent that none was to be had from wells, springs or streams for cattle and other stock, except in the channels of the largest streams of the State, the Des Moines, Iowa and Cedar rivers. I am unable to state personally how near being completely dried up either the Des Moines or Cedar rivers were at that time, but I can state for the Iowa river that all the water running in its channel during that summer passed through a hole two feet square in the penstock of what was called the Company Mills, about two miles and a half above Iowa City. Not a drop of water fell during that season in our part of the country from April to November, and during all this time the weather was extremely hot. The stock of the country had to be herded along streams where water could be had for their sustenance. Plowing fields and breaking prairie had to be given up for that season, and in many cases farmers were compelled to haul water in barrels long distances, in order to sustain themselves in their homes. The drouth from which we suffered in 1846 had begun in other parts of the United States one or two years previously. Two years before the New England region suffered severely, and during the years before the northern part of Ohio suffered so severely that the people along and on the southern border of Lake Erie were obliged to emigrate, for it was impossible to obtain water either for domestic or stock uses throughout a very large region of that country."

In a recent issue of the Fort Dodge *Messenger*, the Hon. L. S. Coffin contributed an interesting leaf from ancient weather records, showing that forty years ago, as in recent years, there was quick transition from extreme drouths to seasons of excessive rains and floods. The latter part of the season of 1854 was extremely dry, followed by a mild and dry winter and a very dry spring, so dry in fact, that one of the early settlers of Webster county drove from Muscatine to Fort Dodge, the last of April (1855,) without wetting his wagon tire.

Prof. T. S. Parvin, in his notes on the climate of Iowa, said: "In 1854 occurred the great drouth in this and the western States generally; but owing to the porous nature of the soil, the crops turned out much better than in the States east of the Mississippi."

These are valuable testimonies, and it should be noted that in that early period but little of the soil had been disturbed by the plow, the aboriginal frog ponds contributed their full quota of vapor and malaria, and the little strips of forest had not been destroyed. So the great drouths of 1846 and 1854, and the intervening excessively wet season of 1851, can not be charged to the account of man's ruthless interference with nature's methods.

In all the years from that early period to the present time, we have had variable seasons, ranging from very wet to extremely dry. The normal summer rainfall for

Iowa is about thirteen inches, or an average of one inch a week for the three months. For the past twenty years the total amount has been above as often as it has been below the normal figure. This mutability of seasons is the result of a natural law, which was in operation fifty years ago as at the present time, but the secret of its working is not yet discovered.

A good many people, possessed of average intelligence, have attempted to account for this season's shortage of rainfall; but the fault of the larger number is their range of observation is too narrow, both as to time and distance. The prevalent theory which I have been reviewing was recently presented in plausible form by a correspondent of the Des Moines *Register*, who said: "A careful study of this problem leads unmistakably to the conclusion that the work of man in this country for the last hundred years has tended to diminish the amount of vapor in the atmosphere and at the same time increase the temperature. * * * Throughout the great central plain thousands of lakes, ponds, sloughs and marshes have been drained every year, and just so much evaporating surface has been destroyed. The cultivation of the soil by allowing the water to enter it freely has prevented the water collecting where it would be exposed directly to the sun's rays. * * * In these extreme western sections the drouths have been made severe in a marked degree because by allowing the water to enter the soil; it is not evaporated so freely and is distributed over a longer period of time, whereas if the water could be turned into vapor in a short time it would often save the growing vegetation from destruction."

Now this would fit the case most admirably if there were some facts to sustain it; but it is short on facts and long on hypothesis. There has been no perceptible decrease in the average percentage of atmospheric humidity in the summer months. The quantity of vapor is variable, but not more so than temperature, sunshine and other elements of weather.

And it is not true that cultivation of soil decreases evaporation. In fact, it can be demonstrated that breaking up the hard and well-nigh impervious prairie sod, turning under the dry and wiry wild grasses, stirring the soil deeply, making it both receptive and retentive of moisture and ready to yield it up for the sustenance of plants, thereby producing heavy crops in place of the scanty native herbage of the plains, serve to increase rather than decrease evaporation and humidity. The original upland prairie was hard at the surface, and measurably impervious, and the heavy rains were carried quickly into the depressions, making their way thence into the larger streams. As the result of breaking and sub-soil plowing the receptive fields absorb a much greater share of the heavy rains than formerly, and the moisture is held therein, and by capillary attraction is made available for growing plants.

The veriest neophite in agricultural science understands that plants draw moisture by their roots and emit it through their leaves. The more plants of deep roots and ample foliage, the more moisture is given to the air. So it follows that an acre of corn or clover yields vastly more vapor than an acre of prairie grass. And more than this, a section of land covered by general farm crops, meadows, corn fields, and well seeded and not too closely grazed pastures, will yield more moisture to the air than an equal area of lake or marsh. There is vastly more vapor arising from a dense grove than from an equal extent of water service.

Therefore one reason why cultivation has dried up the quagmires of the olden times is because the well-tilled fields absorb and retain the moisture and yield it back to the air in the process of growing crops. There are billions more pores emitting moisture into the air in these latter years than were in operation in the olden time. The sloughs have been drained off through the roots, trunks, stems and leaves of the plants which form the immense crops that annually burden Iowa's rich and porous soil. And a tile-drained and well-cultivated field will better resist aridity, and will contribute more vapor to the air, than the same soil in its original condition. So allowing that our summer rainfall depends mainly upon the local manufacture of vapor, we are in a fair way to produce more rather than less of that essential material for rain-making.

But as a matter of fact the greater part of the humidity arising from our soil is borne eastward by the general trend of the winds, and the vapor which is condensed into rain for the watering of our fields is almost wholly an imported article, coming mainly from that vast thermal fountain, the Gulf of Mexico. Those who have closely observed the wind currents and storm movements of this midland region, realize how insignificant a drop-in-the-bucket is contributed by local evaporation to make up all our quota of rainfall.

At the time of the first geological survey of this State the total water surface, or the area of our lakes, rivers and ponds, amounted to 550 square miles, which is about one per cent of the area of the State. Now, if all the water in these rivers, lakes, and ponds could be drawn up into the clouds and distributed equally over the whole surface of the State, the total would not exceed half an inch of rainfall. In order to give us our average quantity of rain (which is an inch per week), these lakes, rivers and ponds would need to be filled up and emptied twice a week during the summer. The total amount of water required to give us our average summer rainfall (13 inches), would make a lake one hundred and ten miles long, fifty miles wide, and about eleven feet deep. It would require a wide expanse of frog pond to furnish sufficient vapor to fill such a lake as that. In fact, if the whole State were a vast, oozy quagmire, sizzling in the sun every day, it would not be sufficient to supply the local demand.

No; the raw material to run our Iowa rain factory is mostly imported from foreign waters, free of duty, and without cost of transportation. It is brought hither usually by the fast freight express, known as the South Wind, by the Gulf Air Line. During the past summer the southern, vapor-laden, freight trains have been side-tracked, ditched, or switched off in other directions, to increase the moisture in regions already over-supplied

with wetness. To them that had an abundance, more was given, and from our parched fields was taken even the little moisture remaining. We can see how it was done, but we cannot exactly understand why there was such great inequality in the distribution of rainfall during the past season.

The United States Weather Bureau published a weekly weather-crop bulletin, including shaded maps showing in black and white the portions of the country wherein there was an excess or deficiency of seasonal rainfall for each week. A careful study of these maps will show where the bulk of the moisture was precipitated, and give at least a partial answer to the question why it did not rain more copiously in Iowa. The drouth began to show its effects about the middle of May, and during that month the eastern and middle states and the northwestern states were saturated, while the Mississippi and Missouri valleys were comparatively dry. In June there was a large amount of rainfall in the middle Rocky Mountain slope, and a great deficiency in the upper Mississippi valley and east Gulf States. In July there were heavy rains in the south Atlantic and east Gulf States, and a general deficiency throughout the northern half of the United States, intensified in the west by the hot winds during the last week of the month. In August the drouth and hot weather covered the greater portion of the country, except the south Atlantic and Gulf States, which were saturated with excess; and there were also excessive rains in Western Texas, causing heavy floods in the valley of the Rio Grande.

It will be seen from this that the great deficiency in this region was in part counterbalanced by excess of rain in other sections. We may be certain that there was the usual amount of rainfall somewhere, to maintain nature's equilibrium of forces and elements.

The drouth this year was much more damaging because it was the culmination of a deficiency covering the period of nearly a full year. There was an unusual shortage in the amount of water stored up in the lower layers of the soil, from which the arable soil has been wont in other years to draw by capillarity a portion of the moisture essential to support growing crops.

The great drouth of '94 is likely to become historic, serving as a datum line for future reference and comparison. The cause was not local but general in its operation. The lack of evaporation in Iowa, or any other part of the dry area, did not affect it in the least. There were temporary changes in the general circulation of the air, whereby drier air, or descending currents became more frequent than in other seasons. There were about the usual number of cyclonic or low pressure areas (storm centers) passing across the continent, but their movements were unusually sluggish and erratic, and the greater number passed so far to the northward that they failed to draw up the valley the humid winds from the Gulf. During June, July and August, only two of these storm centers passed southward of Iowa—most of them hugged the Canada line. So there were not the usual reactions, and sharp contrasts of high and low temperatures, necessary to develop general or even local storms. When the Gulf winds chanced to reach us, with their usual burden of humidity, the boreal breezes were not at hand to wring out the moisture by the process of dynamic cooling.

In a recent issue of the *National Weather Review*, Prof. Cleveland Abbe says: "If we had maps of the weather for the whole globe for every month for a long series of years we should, undoubtedly, be able to find many coincidences, so that a drouth for a given section might be predicted from the rainfall, the snowfall, the temperature, the pressure, or other conditions in a distant part of the globe. As a rule, important drouths or other climatic crises are the result of changes that have been going on slowly for a long time in distant parts of the earth. The general circulation of the air constitutes a complex system in which the areas of high pressure and dry, clear air are the results of slowly descending winds moving towards the equator, and the general rains are formed wherever a descending current of air, a mountain range or other obstacle has an opportunity to push up the moister air of the earth's surface. From this point of view rainy and dry, and hot and cold seasons depend largely upon the varying relations of the upper and lower curents to the continents and even to each other."

In conclusion I would say, don't be troubled about the future of Iowa, nor worried by the fear that the State is about to be desiccated. The past is the best possible guarantee for the future. We shall have wet and dry seasons in about the average number and frequency of change from one extreme to the other. By thorough drainage, subsoiling, the conservation of moisture by means of shelter belts of timber, artificial ponds and artesian or deep wells, we shall in time be able to produce abundant crops and water our stock whether the seasons shall be wet or dry.

SHELTER BELTS.

FROM THE STANDPOINT OF LESSENED EVAPORATION.*

The substance of this paper is implied in its title. Timber belts, properly located, possess great economic value for various purposes, and by no means the least of these good offices is the fact that they furnish a measure of shelter from the destructive effects of hot winds in drouthy seasons.

The past season has furnished some object-lessons demonstrating the utility of sheltering groves when favorably located, and also illustrating the fact that in times of great distress and scarcity the strong may devour the substance and sustenance of the weak. This is as true in the vegetable as in the animal kingdom. The burden of the corn's talk, uttered in husky tones, has been to the same end. Field plants, vines, fruit trees, and garden vegetables were greatly helped during the past season when located at the leeward of ample shelter belts at a distance sufficiently near to obtain a measure of protection against the force of the hot blasts, and far enough away to avoid the danger of being robbed of the little moisture remaining in the soil.

*Substance of a paper read before the State Horticultural Society, December 13, 1894, by J. R. Sage.

The past season has tried men's souls; and blessed are the fruit-growers who have kept their faith and serenity, and preserved even a moderate share of their fruit crops, trees, and vines. It seems marvelous that so much has been saved from utter desiccation, and so many are here to tell the tale.

The records of the Central Station of the State Weather Service furnish some figures illustrating the tremendous forces against which our farmers and fruit-growers had to contend. Here are the figures:

DATE.	Maximum temperature—degrees.	Max. wind movem't, miles an hour	Direction.	Humidity—per cent.
July 25	99	20	SE	13
July 26	104	34	SW	21
July 27	96	28	SW	26
July 28	91	19	W	18
July 29	93	13	SW	30
July 30	94	12	SW	30
Average	96	21	SW	23

Here we have for six days in succession an average maximum temperature of 96 degrees; average maximum wind movement of 21 miles an hour, and an average minimum percentage of humidity of 23 per cent. The wonder is that any form of vegetable life survived the fiery ordeal.

Plant life will endure great heat if there is a corresponding measure of humidity. At the temperature of 98.5 degrees (the temperature of the body), the air can contain 18.96 grains of water in each cubic foot. But when the moisture in the air is reduced to one-fourth of that amount the plants become very thirsty as well as tired, and there are tremendous drafts upon their vitality. That was the chief source of trouble during the prevalence of the drouth last summer. The percentage of humidity in the air was relatively lower than at any previous time on record.

The principal factors of destruction in a drouthy season are great heat, high wind and dry air. The chief value of shelter belts is that they temper the heat, break the force of the wind, and thereby conserve atmospheric humidity and soil moisture. This has been demonstrated by carefully conducted experiments, made under the auspices of the National Weather Bureau. The results of these experiments show that with the temperature of the air at 85 degrees, with a relative humidity of 50 per cent, and the wind blowing at five miles an hour, the evaporation was two and two-tenths greater than in a calm; at a wind velocity of ten miles an hour the evaporation was three and eight-tenths greater; at fifteen miles an hour, four and nine-tenths; at twenty miles, five and seven-tenths; and at thirty miles an hour the wind would evaporate six and three-tenths times more than in a calm. Our normal summer wind movement is about ten miles an hour, and frequently when the heat is at its maximum the velocity of wind rises to twenty or thirty miles, resulting in a very rapid evaporation from soil and plants.

Now, in-so-far as shelter belts break the force of winds at the surface of the earth, they lessen the evaporation in the fields on the leeward side, and measurably protect the tender plants from the effects of scorching blasts. And more than this, if sufficiently dense, they serve to a limited extent as equalizers of temperature and conservators of surplus moisture in wet seasons, to mitigate the severity of short periods of drouth, by increasing local humidity and furnishing trickling streams to supply shortage in adjacent fields. When a grove has fully established forest conditions the surface is heavily mulched and the earth is made porous, serving a better purpose as a reservoir for the storage of surplus rainfall than an equal area of ponds or bogs in the deep ravines and bottoms.

There is no question but that dense timber belts, judiciously located, may make, under certain conditions, all the difference between success and failure in the production of fruit and garden truck in drouthy seasons. There is a sensible difference in the degree of heat and amount of humidity to the windward, as compared to the leeward side of a grove; and though the difference may be slight, it is often sufficient to save from damage or destruction. In many instances even a dense hedge row has materially benefited crops for some distance on the leeward side by breaking the force of hot blasts. It serves a purely mechanical purpose, and a tight board fence of the same height would afford the same measure of protection.

In this region the damaging hot winds of our occasional drouthy periods blow from the south or southwest. This clearly indicates the proper location of a shelter belt. And when practicable the sheltering grove should be near the crest of a divide or ridge, with the orchard, vineyard, or fruit patch on the northern or northeastern slope.

Of course you all understand it is necessary to provide for drainage, and that fields closely shut in by wind breaks or hills are liable to suffer serious losses from rusts, blights and mildews. So the problem to be solved is, how to get the largest measure of benefit of shelter belts in dry seasons without hazard of loss in years of excessive moisture.

This has been a year of surprises, and many of our old time theories have been as badly scorched as the crops by the torrid blasts of the season.

Though I am thoroughly convinced of the economic value of shelter belts, yet I recognize the fact that in this as in most matters there are exceptions and limitations. From one class of observers we have reports that the best crops were harvested from fields situated on the leeward side of groves; others affirm the contrary. In numerous instances shelter belts have served as robbers instead of protectors of the crops in adjacent fields. How do we account for this?

It should be understood that our deciduous trees, especially those of most rapid growth, require a vast deal of moisture for their support. Some of them, as for example the willows and cottonwoods, send their roots long distances in search of moisture. They will break through brick walls of cisterns and wells, and envelop and destroy tile drains in search of water. In fact, a man told

me that one of his neighbors had told him that during one very dry season a root of a cottonwood tree actually chased a hired girl clear across his yard to get at the bucket of water she was carrying! I never quite credited that story, however.

But trees require a vast deal of water for their own use, and that is why they get together in groups and forests and set to work to mulch the soil to make it retentive of moisture for use in time of need. A single tree draws water through its roots, and by transpiration pours forth many thousand cubic yards of vapor every day. And the larger the grove the heavier drafts are made upon the reservoirs of moisture in the earth.

So then, it follows that in a protracted drouth, when the subterranean reservoirs are about exhausted, it becomes a life and death struggle between the trees and other forms of vegetable life. The stronger survive; the weaker succumb and die.

Much depends, therefore, upon the location of the shelter belt, its distance from the fields needing shelter, the nature of the subsoil, and the duration of the drouth. A grove that may afford ample protection for a short season of drouth may become a source of destruction, or a devouring monster, in a season of greater aridity. In extremely dry seasons the forests become in time more arid than the cultivated fields, so that they burn like tinder, and the fires delve downward to consume the very roots and the black mold of the rich earth.

There is no danger, however, of planting too many trees, or of having an excessive number of shelter belts. The principal need is to use due care in their location. It would unquestionably enhance the value of the farms of Iowa, and add millions to the value of the products of fields and orchards, if at least five million acres could be added to our present area of groves and forests.

DO BATTLES BRING RAIN?

EXTRACTS FROM A DAIRY KEPT DURING THE CIVIL WAR, BY W. S. FULTZ, CO. D, ELEVENTH IOWA INFANTRY.

April, 1862, on the 4th a severe storm of hail and rain; 5th, Whippoorwills calling and frogs croaking; considered a sign of rain. April 6th, Battle of Shiloh; rained hard during the night. On the 11th, rained all the afternoon; the first rain since close of the battle; 18th, 19th, 20th and 21st, rained each day; no firing since the 8th.

May 28, 1862, siege of Corinth; heavy firing on the lines; no rain.

June 16th, rained all the afternoon; 17th, rained at night.

September 19th, Battle of Iuka.

October 3d and 4th, Battle of Corinth. No rain between the two battles. October 10th, rained hard in the afternoon.

April 16, 1863. During the night the fleet ran the blockade at Vicksburg; heavy firing. April 17th, commenced raining at 7:00 P. M and rained hard until midnight.

May 18, 1863, the siege of Vicksburg began, and ended July 4th, with more or less firing each day, at times very heavy. Rain occurred on May 21st and 30th, June 10th, 23d and 24th (not more than usual amount for that region)

July 7th, rained hard all night till morning of 8th. On the 10th the second siege of Jackson began and lasted till the 17th; there is no record of any rain during that time, nor until the 22d of July.

On the 10th of June, 1864, we arrived at Big Shanty and the siege of Kenesaw Mountain began; a great deal of firing every day, often reaching the extent of a battle. June 11th and 12th, rained all night. Also rained more or less on June 17th, 18th, 19th, 21st and 30th. July 1st and 2d, firing very brisk; rained during afternoon of the 2d. July 4th, 5th, 6th, 7th and 8th, firing was very brisk and no rain until the evening of the 10th, when we had a shower.

July 20, 1864, began the siege of Atlanta, with hard fighting and heavy firing on the 21st and 22d. The weather was pleasant until the 27th, when we had a rain all the afternoon. July 28th, another battle; record shows warm and fair weather until August 1st, when it rained in afternoon.

August 3d, hard shower; the firing brisk on the picket line. Heavy firing on 4th and 6th, rain on 6th. August 7th, cannonading heavy; rain on afternoon of 8th and on 10th. Heavy firing 12th, 13th, 14th and 15th; slight shower on evening of 15th. August 16th, 17th, 18th, 19th, 20th and 21st, firing very brisk; rained nearly all day on the 21st; fair on the other days. August 22d, 23d, 24th, firing was very brisk; the weather was very warm and fair until September 2d, when it rained all the afternoon and all the following night and on afternoon of the 3d. September 5th, considerable firing; rained hard in the evening. September 6th, rained in afternoon.

The battle of Altoona was fought October 5, 1864, and my notes show that it rained that night and nearly all day the 6th.

On the 10th of December the siege of Savannah began; it rained the following night, but did not rain again until the morning of the 21st, though the cannonading was more or less brisk in the intervening time.

During the war the general belief in the army was that a battle was sure to bring rain, but the record disproves the theory. Taking the entire time during the war the record shows that it rained as frequently when there was no firing as when the battle raged most heavily; and neither the concussion nor the smoke of the battle caused more frequent rainfall.

Muscatine, Iowa.

THE DEATH VALLEY EXPEDITION.

BY PROF. L. H. PAMMEL.

It is appropriate and fitting at this time to make a brief review of an excellent paper by Prof. Coville on plants and climate.

In 1886 Congress made an appropriation for a study of the geographic distribution of animals to be conducted by the Division of Ornithology and Mammalogy of the United States Department of Agriculture. In 1890 Congress enlarged the scope of the work so as to include the distribution of plants as well as animals. The Death

Valley expedition was planned and carried out under the direction of Dr. C Hart Merriam, chief of the division. The Botanical work was undertaken by Frederick Vernon Coville, now chief of the Division of Botany. The result of his work has been brought together in a volume[1].

Some of the facts may be of general interest and I here give a short review although somewhat tardily.

The excessive dryness of the atmosphere is shown by the fact "that the pencil marks on a roadside grave board, which had been twelve years exposed to atmospheric effects, still appeared clear and fresh, the surface of the wood retaining its natural appearance, not changing to the grey color of weathered timber."

The first part of the volume deals with principles of plant distribution. The factors of plant growth depending upon heat, light, water, foul air and mechanique. As to water, the plant deals principally with soil moisture, but the moisture in the air has an important influence upon the plant; the greater the degree of humidity the less transpiration.

The observations of the Weather Bureau for five months, May to September, 1891, show a total amount of rainfall during that time of 1 4 inches, but this rainfall is not distributed uniformly through the year. "An average of ten Weather Bureau Stations in the adjacent desert region probably represent more nearly the actual rainfall in Death Valley; this average is 5.155 inches." This will not support any ordinary vegetation. At Dodge City, Kansas, from 1874 to 1883, the mean annual rainfall is 20.09 inches. Wheat, sorghum and alfalfa cannot be grown without irrigation, except in favorable seasons. In Death Valley the rainy months are January, February and March. In regard to relative humidity, Lieutenant Finley states, for five months it was 18.6 per cent; in July, 12.6; for August, 13; on the 4th and 5th of August a minimum of 5 per cent was attained. Such air possesses large capabilities for evaporation. Not many plants have developed a large absorptive root surface and a sufficiently small slowly evaporative leaf and stem surface to keep from drying up.

The seeds of annual plants rapidly germinate, after rains. The plant grows, but stops when moisture ceases. The period of growth is variable in its beginning and in its duration. The fall rains cause the autumn blooming of desert plants, and the different amounts of spring rains decide the vigor of spring growth during different years. Mr. C. R. Orcutt found in the Colorado desert specimens of an *Amarantus* ten feet high; a year later he collected specimens of the same species, in the same place, only four inches high. On hygroscopic water for plants, Prof. Coville says: "From several months' observations of desert conditions and phenomena, it appears to the writer extremely probable that a very important proportion, if not, indeed, in some cases, all of the summer water supply of certain desert shrubs is conserved in such a manner."

Another most interesting fact is the range in temperature. The average daily range during August was 32 degrees. At Bennett Wells it was from 73 to 31 degrees, a difference of 42 degrees. It must require special conditions of a plant to endure such sudden changes. It would indeed be interesting to study such plants from a physiological and histological standpoint.

In the list of desert plants we find the following facts of different species:

PLANTS OF HUMID HABITAT—AQUATIC—GROWING IN WATER.

TREES.	SHRUBS.	PERENNIALS.	ANNUALS.
None.	None.	7	None.
PALUDOSE:	GROWING IN W	ET SOIL.	
5	14	54	11
RUPESTRINE:	GROWING IN CA	NONS AND ROCK	
	SHELTERED SLO	PES.	
0	4	10	5
CAMPESTRINE:	GROWING ON MI	SAS, WASHES,	
	SAND-WASTES. C	LAYEY, VALLEY	LOAM.
2	54	30	107

The desert plants are peculiar in their growth, the shrubs develop in every direction equally, they are rounded or globular, their struggle is not against other plants but against non-organic physical forces. The leaf surface of annuals is well developed, many have soft herbaceous foliage, none have thick succulent leaves, few indeed have marked modifications to prevent rapid transpiration. A few are canescent.

The author suggests that one function of hairy coverings is to prevent extremes or rapid radiation, great radiation ensues after sunset because of the clearness and dryness of the atmosphere. We cannot here dwell on the many excellent points brought out in the paper. The original should be consulted, which can be obtained from the Department of Agriculture, Washington, D. C.

[1]Botany of the Death Valley Expedition, Issued Nov. 29, 1893. Contributions from the U. S. National Herbarium, Vol. IV.

JANUARY'S PAST WEATHER RECORD.

DES MOINES—SEVENTEEN YEARS' RECORD

TEMPERATURE—Mean or normal, 17°. The warmest January was that of 1880, with an average of 37°. The coldest January was that of 1888, with an average of 7°. The highest temperature during any January was 63°, on the 18th, 1880. The lowest temperature during any January was 30° below zero on the 5th, 1884.

PRECIPITATION—Average for the month, 1.34 inches. Average number of days with .01 of an inch or more, 10. The greatest monthly precipitation was 3.47 inches in 1886. The least monthly precipitation was 0.56 inches in 1893. The greatest amount of precipitation recorded in any 24 consecutive hours was 1.35 inches on the 12th and 13th, 1890. The greatest amount of snowfall recorded in 24 consecutive hours (record extending to the winter of 1884–5 only), was 12 inches on the 12th, 1890.

CLOUDS AND WEATHER—Average number of clear days, 12. Average number of partly cloudy days, 10. Average number of cloudy days, 9.

WIND—The prevailing winds have been from the northwest. The highest velocity of the wind during any January was 40 miles on the 1st, 1892, from the northwest.

DAVENPORT—TWENTY-THREE YEARS' RECORD.

TEMPERATURE—Mean or normal, 19°. The warmest January was that of 1880, with an average of 37°. The

coldest January was that of 1875, with an aver age of 8° The highest temperature during any January was 62° on the 17th, 1894. The lowest temperature during any January was 27° below zero on the 5th, 1884.

PRECIPITATION—Average for the month, 1.71 inches. Average number of days with .01 of an inch or more, 10. The greatest monthly precipitation was 4.34 inches in 1874. The least monthly precipitation was 0.13 inches in 1874. The greatest amount of precipitation recorded in any 24 consecutive hours was 1.85 inches on the 1st, 1876. The greatest amount of snowfall recorded in 24 consecutive hours (record extending to winter of 1884-5 only), was 7 inches on the 12th and 13th, 1888.

CLOUDS AND WEATHER—Average number of clear days, 9. Average number of partly cloudy days, 11. Average number of cloudy days, 11.

WIND—The prevailing winds have been from the northwest The highest velocity of the wind during any January was 60 miles on the 1st, 1876.

KEOKUK—TWENTY-THREE YEARS' RECORD.

TEMPERATURE—Mean or normal, 24°. The warmest January was that of 1880, with an average of 41°. The coldest January was that of 1888, with an average of 15°. The highest temperature during any January was 69° on the 17th, 1894. The lowest temperature during any January was 26° below zero on the 29th, 1875.

PRECIPITATION—Average for the month, 1.73 inches. Average number of days with .01 of an inch or more, 9. The greatest monthly precipitation was 3.92 inches in 1874. The least monthly precipitation was 0.07 inches in 1872. The greatest amount of precipitation recorded in any 24 consecutive hours was 1.81 inches on the 1st, 1876. The greatest amount of snowfall recorded in 24 consecutive hours (record extending to winter of 1884-5 only), was 7.0 inches on the 20th, 1886.

CLOUDS AND WEATHER—Average number of clear days, 3. Average number of partly cloudy days, 11. Average number of cloudy days, 12.

WIND—The prevailing winds have been from the northwest. The highest velocity of the wind during any January was 50 miles on the 1st, 1876.

SIOUX CITY—FIVE YEARS' RECORD.

TEMPERATURE—Mean or normal, 17°. The warmest January was that of 1891, with an average of 28°. The coldest January was that of 1893, with an average of 13°. The highest temperature during any January was 58° on the 19th, 1891. The lowest temperature during any January was 28° below zero on the 19th, 1892.

PRECIPITATION—Average for the month, .83 inches. Average number of days with .01 of an inch or more, 7. The greatest monthly precipitation was 1.66 inches in 1891. The least monthly precipitation was .34 inches in 1893. The greatest amount of precipitation recorded in any 24 consecutive hours was .80 inches on the 28th and 29th, 1891. The greatest amount of snowfall recorded in 24 consecutive hours (record extending to winter of 1889-90 only), was 11 inches on the 28th and 29th, 1891.

CLOUDS AND WEATHER—Average number of clear days, 12. Average number of partly cloudy days, 10. Average number of cloudy days, 9.

WIND—The prevailing winds have been from the northwest. The highest velocity of the wind during any January was 43 miles on the 31st, 1893.

NATIONAL BULLETIN FOR NOVEMBER.

WASHINGTON, D. C., December 1, 1894.

TEMPERATURE.—The month of November was warmer than usual over the Rocky Mountain slope and thence westward to the Pacific coast and over the greater portion of Texas. The average daily temperature excess amounted to 3°, or more, over nearly the whole of the regions named, and over the central Rocky Mountain districts ranged from 6° to 9°, the greatest excess occurring in western Wyoming. Throughout the Mississippi Valley and in all districts to the eastward the month was colder than usual, the temperature averaging from 3° to 6° below the normal from Minnesota, Iowa, and northern Missouri eastward to the New England and middle Atlantic coasts, the greatest deficiency occurring in the Lake region and upper Mississippi Valley. In the south Atlantic and east Gulf States the average temperature of the month, though generally deficient, was but slightly below the normal.

From the 5th to the 9th unusually warm weather for the season prevailed over Arizona and portions of California. Exceptionally high temperatures for the season also occurred over the eastern Rocky Mountain slope between the 11th and 15th, on which dates numerous stations reported the highest yet observed in the second decade of November.

PRECIPITATION—Except over a few areas of comparatively limited extent, November was a very dry month. On the coast of Washington, over the Upper Michigan Peninsula, southern New England, and coasts of Florida and Georgia, the precipitation exceeded the November average, the excess amounting to from 1 to 2 inches over the Upper Michigan Peninsula, southeastern Georgia and northeastern Florida. Slight local excesses are reported from southeastern Iowa, northern New York, and the northern portions of Minnesota and North Dakota. In all other districts the precipitation was less than the average for November, marked deficiencies occurring in Texas, the Central Valleys, lower Lake region, and on the middle Atlantic coast from southern New Jersey to North Carolina, and in the central Gulf states.

From the Gulf coast northward to the Missouri and Ohio valleys, including the lower lake region, from 1 to 4 inches less than the normal amount of rain fell. The deficiency on the Pacific coast southward of Washington was also very decided, but little rain, generally less than half an inch, having fallen in that region during the month.

Throughout the winter-wheat belt the actual rainfall was generally less than two inches, or less than half the normal amount, and over much of the central and western portions of the cotton region the actual precipitation did not exceed one-fourth of the average, Alabama and portions of Georgia, Mississippi, Arkansas, and Louisiana receiving less than one inch, while over

western Texas, Oklahoma and Kansas, and thence westward to southern California, no appreciable amount of rain fell.

The month closes with but little snow on the ground, except over the northern Michigan Peninsula, portions of which are covered with from 8 to 9 inche . A depth of three inches is reported from northern Minnesota, and in portions of New England there is a light covering of from 1 to 2 inches.

MARK W. HARRINGTON,
Chief of Bureau.

NOVEMBER WEATHER RECORD.

The month of November was generally favorable for farm work, but too dry for the farmers' needs, especially in localities where there was a scarcity of stock water.

The daily mean temperature was 32.7° for the State—about 1.5° below the monthly normal. The highest temperature reported was 72° on the 15th at Keokuk; lowest, 5° below zero on the 19th at Forest City.

The average precipitation for the State was 0.92 of an inch—.84 of an inch below the November normal. The greatest amount reported was 2.42 inches at Seymour; least amount a trace at Rock Rapids.

The following table gives, as a basis of comparison, the mean temperature and total precipitation for the month of November, at the stations named, for the years from 1872 to 1894 inclusive:

YEARS.	MEAN TEMPERATURE, DEGREES.					PRECIPITATION, INCHES.				
	Des Moines.	Davenport.	Keokuk.	Omaha.	Sioux City.	Des Moines.	Davenport.	Keokuk.	Omaha.	Sioux City.
1872	....	32	33	30	....	....	1.86	0.74	0.87	.....
1873	....	34	37	38	....	.....	0.63	1.43	0.19	.....
1874	....	36	40	36	....	.....	2.47	2.17	1.05	.....
1875	....	33	36	33	....	.....	0.57	0.59	0.13	.....
1876	....	35	37	33	....	....	2.54	2.82	1.17	.....
1877	....	37	40	36	....	....	2.53	3.05	1.36	.....
1878	42	42	44	44	....	0.34	0.90	1.93	0.27	.....
1879	39	40	42	40	....	6.49	4.70	3.91	4.25	.....
1880	28	31	31	26	....	1.97	1.23	1.13	0.70	.....
1881	36	40	40	37	....	3.97	2.19	2.59	1.29	.....
1882	39	42	42	40	....	2.81	1.47	2.25	2.05	....
1883	39	42	43	39	....	1.32	3.58	2.09	0.64	.....
1884	38	40	41	39	....	1.26	1.49	1.73	0.32	.....
1885	39	38	42	40	....	0.61	1.20	0.88	0.73	.....
1886	36	35	39	34	....	1.86	0.74	1.15	1.54	....
1887	37	37	42	40	....	0.52	1.13	1.18	0.89	.....
1888	36	38	42	37	....	2.09	3.54	2.83	0.12	....
1889	34	37	38	36	33	1.29	2.17	1.80	0.87	1.99
1890	41	42	44	42	40	0.74	1.37	1.57	1.01	.84
1891	32	32	36	34	30	1.34	3.56	3.60	0.37	.37
1892	35	33	36	38	35	0.76	2.01	3.16	0.14	.16
1893	36	36	39	37	34	1.51	2.56	2.29	0.43	.75
1894	34	34	37	37	33	0.99	1.26	2.24	0.11	.17
Means	36	39	41	37	34	1.75	1.98	1.96	1.03	.71

SUMMARY OF WEATHER CONDITIONS.

BAROMETER—Mean pressure for the month, 30.14 inches. Highest observed, 30.80 inches, at Cresco, on the 28th. Lowest observed, 29.32 inches at Sioux City, on the 15th. Range for the State, 1.48 inches.

TEMPERATURE—Monthly mean, as deduced from 70 voluntary observers' reports, was 32.7°. Highest monthly mean 37.6° at Ft. Madison. Lowest monthly mean 26° at Forest City. The highest temperature reported was 72° at Keokuk, on the 15th. The lowest temperature reported was 5° below zero at Forest City on the 19th. The average daily minimum was 22.8°; the average daily maximum was 42.2°; the average monthly maximum was 62.6°; the average monthly minimum was 2.5°. The greatest monthly range was 70° at Ogden. The least monthly range was 46° at Sac City.

PRECIPITATION—Average for the State as determined from 76 voluntary observers' reports, .92 of an inch. The largest amount reported was 2.42 inches at Seymour. The least amount reported was "a trace" at Rock Rapids. The greatest daily rainfall reported was 1.73 inches at Monticello on the 2d.

AURORAS—Alta on the 17th, giant low arch.

HALO, LUNAR, Amana, 11th; Ovid, 7th.

HALO, SOLAR, Cresco, 11th.

HIGH WINDS, Cedar Rapids, 16th and 27th; Fairfield, 9th; Greenfield, 9th and 10th; Humboldt, 20th.

LIGHTNING observed in the southwest at Emmetsburg on the 30th.

FOGS, Osceola, 29th and 30th; Des Moines, 29th; Ovid, 29th and 30th.

Ovid and Ottumwa were the only places in the State reporting storms during the month of November, 1894.

Snowfall ranged from a trace to 4.0 inches, but usually melted as it fell.

ATMOSPHERIC PRESSURE.

STATIONS.	Mean reduced barometer.	EXTREMES.			
		Highest reduced barometer.	Date.	Lowest reduced barometer.	Date.
Cedar Rapids	30.14	30.78	28	29.37	15
Clarinda	30.15	30.75	28	29.65	15
Cresco	30.12	30.80	28	29.44	15
Davenport	30 10	30.70	28	29.44	15
Des Moines	30.16	30.76	28	29.36	15
Keokuk	30.14	30.72	28	29.51	15
Omaha (Neb.)	30.18	30 72	28	29.38	15
Sioux City	30.15	30.72	28	29.32	15
Means	30.14	30.80	28	29.32	15

WIND MOVEMENT.

STATIONS.	Number of miles.	Maximum velocity.	Direction.	Date.
Davenport	7,871	42	NW	9
Des Moines	6,889	36	NW	9
Keokuk	6,579	38	NW	9
La Crosse (Wis.)	6,373	28	W	24
Omaha (Neb.)	6,247	28	NW	15
Sioux City	8 980	48	NW	9

OBSERVERS' NOTES.

Clinton—DR. LUKE ROBERTS. November, 1894, was nearly normal in all its weather conditions. The maximum temperature was 1° below, and the minimum 1° below normal, but the mean was only .7° below. The range of November mean temperature for the last sixteen years was 12.4°; that of the year 1880 being the lowest, 25.4°, and that of 1890 the highest, 37.8°. The balance

of the years the range was between 31.7° in 1891, and 37.4° in 1888.

The warmest day was 3.5° colder than like November days, and the coldest day was 5.2° warmer than November cold days. The per cent of cloudiness was high, being 10 per cent above normal.

The total movement of the wind was 1,250 miles in excess of normal, and its prevailing direction from the northwest. The maximum velocity was 27 miles an hour, occurring on the 9th. On this day the wind made 480 miles from the northwest.

There were eight storm days, but the major portion of precipitation came on the first and second, rain commencing at 10:45 P. M. on the 1st and continuing to 6:45 P. M. of the 2d, leaving a deposit of 1 86 inches. The total fall of water for the month was 1.75 inches—.32 of an inch less than a November normal.

The first snow of the season came on the early morning of the 7th. It was not of measurable amount. On the 10th the air was charged with snow, and on the evening of the 12th and up to 8 A. M. of the 13th a sufficient quantity of snow fell to slightly cover the ground, producing .03 of an inch of water. The 9th furnished a sleet storm to the amount of .14 of an inch of water. A diminutive storm of only .09 of an inch of water, which came in the early hours of the 29th, commanded more attention than all the storms or phenomena of the month. It was pure sleet and made it unpleasant and dangerous for man or beast to travel on walks or paving. It being Thanksgiving Day there was an unusual inclination to offer up thanks, as one after another made their pedestrian rounds, and arrived at their destination without bruises or broken limbs. On the morning of the 30th the roads and walks had received additional polish, but whether a corresponding increase of thanks were offered up the writer is not supposed to know. But this much will be proper to say: after 10 o'clock the danger was over.

The mean temperature of the month was 33.5°. The maximum was 65° occurring on the 15th. The minimum 8°, on the 19th. The mean temperature for the warmest day was 49° on the 15th. The mean temperature for the coldest day was 17.5° on the 19th. Total rainfall, 1.75 inches. Total movement of wind, 5,440 miles. Per cent of cloudiness, .61.

Shenandoah—A. A. ATWOOD. First killing frost of the season October 8th—ice three-eighths of an inch thick. November was windy and cold. More than the usual amount of winter wheat and rye sown and doing well. Larger acreage of fall plowing than usual. About 60 per cent of the corn was cut for fodder—selling in the shock of 15 hills at 20 to 35 cents each.

Fort Dodge—R. W. BLAIN. The precipitation for the month of November was .18 of an inch. The highest temperature at 1 P. M. was 56° on the 26th; lowest temperature at 6 A. M. was 1° above zero on the 28th. High winds on the 20th and 25th with clouds of dust.

Bonaparte.—HON. B. R. VALE: The month was warm and pleasant, a little dry but profitable to man and kind to beast.

Cedar Rapids—H. D. OLDS: No thunder during the month. High winds on the 16th and 27th, from the north and northwest, very nearly a gale, but little damage done in this vicinity.

Larabee—H. B. STREVER: Very light rain and snow denote a continuance of the droughtly conditions. Roads dry, hard and dusty, wells and streams very low. High winds blowing soil in clouds of dust from plowed fields and corn fields from which the stocks have been removed.

Williams.—MERTON L. FULLER: Only a trace of snow during the month. Ground is dry and roads dusty. Drouth and freezing is injurious to the heretofore good showing of winter wheat, more rain is needed for stock water and snow for protection of vegetation.

SOLAR OBSERVATIONS, OCTOBER, 1894.—ALTA, IOWA.

BY DAVID M. HADDEN.

Date.	CENTRAL TIME.	NUMBER VISIBLE		Faculæ.	Definition.	REMARKS.
		Groups.	Spots.			
5	5:15 P. M.	6	70	4	Good.	Fine large group about three days in from SE limb in extension area of facule. Large faculæ in NE quadrant containing 3 groups of spots.
6	5:20 P. M.	5	65	4	Good.	The large group apparently unchanged, one less group in NE quadrant and spots are larger. Observations with spectroscope were poor. Much distortion was noticed in the C line, being greatest towards the blue end of spectrum.
8	....	6	58	4	Good.	The larger group is about on meridian and is increasing in extent; it has 3 groups of dark spots and numerous smaller ones.
10	5:10 P. M.	4	54	3	Fair.	The large group still a fine object; it has a square of penumbra containing four black nuclei on following side of group, also fairly large group near the meridian in N latitude.
12	5:10 P. M.	7	36	3	Poor.	Large group much diminished in size, and is now near SW limb, disappearing by solar rotation.
14	3:15 P. M.	4	15	3	Good.	All groups are W of meridian.
15	5:10 P. M.	3	13	3	Fair.	
16	5:10 P. M.	2	7	4	Fair.	Facula by rotation.
17	5:15 P. M.	2	-	-	Poor.	Seen too low; small group, E limb.
19	2:50 P. M.	3	8	2	Good.	Group one day in; all groups near E limb.
21	3:30 P. M.	7	about 35	7	Good.	Three groups prominent; faculæ by rotation E limb. New group E limb. Small low prominence on E limb.
23	11:30 A. M.	6	about 20	3	Fair.	Groups mostly small.

BELATED REPORTS.

Belle Plaine (October, 1894).—Mean temperature 51.1°; maximum temperature 80° on the 18th and 20th; minimum temperature 24° on the 9th. Total rainfall 2.09 inches. Number clear days 13; part cloudy 6; cloudy 12. Rain fell on 12.

Rock Rapids (October, 1894).—Mean temperature 52.7°; highest observed, 80° on the 16th; lowest observed 28° on the 30th. Total rainfall 2.06 inches. Number of clear days 16; part cloudy 11; cloudy 4. Rain fell on 3. Prevailing wind, north. Snowfall, .05 inch.

METEOROLOGICAL DATA FOR NOVEMBER, 1894.

STATIONS.	TEMPERATURE OF THE AIR. (IN DEGREES FAHRENHEIT.)								Precipitation in inches—Monthly.	Precipitation in inches—Greatest daily.	Total snowfall.	Prevailing direction of wind.	No. of cloudless days.	No. of partly cloudy days.	No. of cloudy days.	No. of rainy days (.01 inch or more).	No. of thunder storms.
	Monthly mean.	EXTREMES. Mean maximum.	Mean minimum.	Maximum.	Date.	Minimum.	Date.	Monthly range.									
Afton	35.2	44.8	25.5	65	15	1	28	64	0.58	.44	...	NW	5	20	5	12	
Algona	29.6	...	...	62	26	2	18	60	.17	.57	T	NW	6	12	12	1	
Alta	30.1	39.5	20.7	62	26	-1	19	63	.26	.14	6	NW	10	12	8	7	
Amana	32.1	40.7	23.5	62	15	3	19	59	1.64	1.60	...	NW	11	9	10	2	
Atlantic	32.2	43.1	21.2	65	26	4	19	61	.20	.13	...	NW	14	6	10	2	
Near Atlantic	34.0	43.7	24.5	62	26	6	10, 28	56	.31	.15	T	NW	8	14	8	4	
Ames	31.2	40.0	22.3	58	3	...	19	58	.45	.25	...	NW	...	...	...	...	
Audubon	33.8	44.5	23.1	63	26	2	19	61	...	...	...	NW	1	13	16	...	
Belle Plaine	32.3	42.0	22.0	62	15, 26	2	19	60	1.17	.80	...	W	9	5	16	5	
Bonaparte	35.1	45.1	25.2	68	15	4	19	64	1.80	1.00	..	...	...	...	...	6	
Carroll	31.7	42.2	21.1	62	26	...	18	60	.29	.11	.1	...	6	12	12	4	
Cedar Falls	31.1	40.9	21.7	65	26	-2	19	63	.98	.50	T	NW	12	6	12	2	
Cedar Rapids	34.0	...	...	60	15	7	19	53	1.53	1.44	T	NW	11	8	11	4	
Charles City	28.8	35.3	22.3	50	3, 15	-1	19	51	1.02	.60	10.0	NW	...	...	...	3	
Clarinda	34.7	45.0	24.5	66	15	8	19	58	.55	.31	...	S	16	9	5	3	
Clinton	33.2	41.3	25.1	65	15	8	19	57	1.75	1.36	T	NW	6	12	12	8	
College Springs	36.6	49.2	23.7	67	26	6	19	61	.45	.30	...	S	6	20	4	2	
Corning	35.6	46.6	24.7	66	15, 26	5	19	61	.85	.40	T	NW	13	10	7	2	
Cresco	27.5	35.2	19.2	57	26	-1	19	58	.90	.46	.1	NW	3	13	14	4	
Davenport	34.0	40.9	27.0	66	15	7	19	59	1.26	...	...	NW	4	12	14	7	
Decorah	30.0	38.7	21.3	57	26	1	19	56	.98	.46	5	...	7	15	8	4	
Delaware	29.2	...	...	60	26	3	19	57	1.73	.86	...	NW S	2	17	11	5	
Des Moines	34.0	42.8	26.0	66	26	4	19	62	.99	.49	T	NW	8	13	9	3	
Dubuque	33.2	41.7	24.8	62	1	6	19	56	1.53	1.40	T	N	7	4	19	4	
Elkader	29.9	38.3	21.4	59	26	3	19	56	1.55	.96	2.8	NW	6	15	9	5	
Emmetsburg	29.0	39.1	19.0	66	26	-2	19	68	.43	.17	T	S	12	8	10	4	
Fairfield	33.8	43.2	24.1	64	15	4	19	60	1.66	1.48	T	...	13	7	10	6	
Forest City	26.0	37.8	14.2	61	27	-5	19	66	(?)		T	N	3	8	14	...	
Ft. Madison	37.6	...	...	64	15, 26	11	19	53	2.09	.92	...	SW	6	8	16	4	
Galva	32.0	44.1	20.2	64	15	...	19	64	.21	.11	T	...	...	...	...	3	
Glenwood	35.0	46.9	23.2	68	12	6	11, 19	62	.01	.01	...	NW	15	11	4	1	
Grand Meadow	29.9	...	...	50	15	3	19	47	1.43	...	...	NW	2	16	12	6	
Greenfield	34.5	45.4	21.9	65	26	2	18	63	.53	.35	T	S	14	7	9	4	
Grinnell	33.6	41.7	25.5	58	18, 16	4	19	54	1.15	.50	...	NW	10	9	11	5	
Grundy Center	31.0	39.6	22.5	64	26	-1	18	65	.47	.40	...	NW	13	11	6	2	
Hampton	29.1	38.7	19 1	63	26	-3	19	66	.41	.18	...	NW	3	19	5	3	
Hawkeye	...	...	...	...	...	...	...	...	1.38	.78	4.0	...	...	...	...	...	
Hopeville	34.5	44.3	24.9	66	15	4	19	62	1.19	.92	...	NW	1	26	3	6	
Hopkinton	32.6	38.6	26.9	58	15	5	19	53	1.60	1.35	...	SE	....	19	11	3	
Humboldt	...	...	...	...	...	...	...	...	.22	.10	...	S	7	15	8	4	
Independence	31.6	42.4	29.9	61	26	.....	19	61	1.11	1.00	1.1	NW	10	11	9	3	
Indianola	33.2	44.1	22.2	63	26	...	28	63	.83	.50	...	NW	...	...	...	3	
Iowa City	34.0	44.3	23.7	64	15	3	19	61	1.80	1.62	...	NW	3	16	11	2	
Iowa Falls	28 9	38.8	19.0	64	25	-3	19	67	.25	.15	...	...	...	...	...	3	
Keokuk	37.0	45.2	28.1	72	15	8	19	64	2.24	.58	...	NW	14	5	11	6	
Keosauqua	37.2	46.7	27.7	69	15	9	19	60	1.41	1.12	T	...	...	...	...	4	
Knoxville	34.5	44.7	24.2	63	3, 26	3	19	60	.96	.81	T	NW	15	9	6	2	
Larrabee	30.4	42.6	18.3	64	26	-4	19	68	.37	.25	T	...	...	...	...	3	
Le Claire	...	...	...	...	...	...	...	...	1.48	.85	...	...	...	...	...	9	
Logan	32.3	42.7	22.0	62	3, 14	5	11, 19	57	...	...	...	...	16	9	5	...	
Mason City	27.6	37 8	17.4	59	26	-4	18, 19	63	.33	.16	...	...	4	...	26	5	
Mechanicsville	30.9	40.0	21 8	62	15	4	19	58	.18	.15	..	W	2	12	16	3	
Monticello	30.7	37.6	22.9	55	26	2	19	53	2.03	1.73	...	NW	13	8	9	6	
Mt. Vernon	32.3	...	...	60	15	2	19	58	...	...	...	...	...	...	...	...	
Newton	33.2	43.3	23.2	63	15	1	19	62	82	.46	..	NW	10	12	8	4	
North McGregor	...	...	...	...	...	...	...	...	1.11	.70	...	...	...	...	...	7	
Ogden	31.1	42.6	19.5	69	26	-1	19	70	.26	.09	...	...	...	...	...	...	
Omaha (Neb.)	37.0	46.2	28.0	64	26	8	19	56	.11	.10	...	NW	10	10	10	2	
Osage	26.7	...	...	...	...	...	...	...	.70	.39	10.0	NW	3	14	13	3	
Osceola	33.9	43.0	25.0	64	15	3	19	61	1.28	1.00	...	NW	11	11	8	3	
Oskaloosa	34.2	43.6	24.7	66	15	3	19	63	1.44	1.37	.2	NW	14	3	13	5	
Ottumwa	35.2	44.8	26.6	63	15	5	19	58	1.65	.86	T	W	14	10	6	4	1
Ovid	34.8	45 1	24.7	68	15, 26	4	19	64	1.70	1.21	T	NW	12	9	9	5	
Panama	33.0	43.3	22 8	63	26	5	19	58	1.26	...	...	...	...	...	...	...	
Richland	33.9	...	...	65	15	6	19	59	1.58	1.45	...	...	4	21	5	3	
Rockwell City	30.1	42.0	18 3	65	28	-1	18	66	.11	.11	..	...	12	13	5	1	
Rock Rapids	31.5	43.1	19.5	60	26	-2	19	62	T	T	...	NW	5	20	5	...	
Sac City	30.7	38.5	23.0	49	25	3	28	46	.20	.10	1.0	NW	6	12	12	2	
Seymour	35.5	45.7	25.3	68	26	5	19	63	2.42	1.60	T	NW	22	4	4	...	
Sibley	30.4	42.0	18.6	59	4, 26	-3	19	62	.29	.11	...	NW	7	11	12	3	
Sioux City	33.0	43.5	23.7	63	26	6	19	57	.17	...	...	...	...	...	...	...	
Spirit Lake	29.4	39.9	18.9	62	26	-4	19	66	.25	.15	T	NW	...	...	...	2	
Villisca	34.2	45.2	23.3	65	15	6	19	59	.51	.29	...	NW	10	11	9	4	
Vinton	31.5	...	...	...	...	...	...	...	.90	.90	...	NW	12	11	7	1	
Washington	33 0	42.6	23.5	67	15	8	17, 28	59	1.45	1.40	....	NW	....	...	...	2	
Waukee	35.6	40.0	25.1	67	15	3	19	64	1.16	48	....	...	...	...	...	5	
Webster City	30.0	...	...	54	15	3	28	51	.75	.25	....	SE	9	10	11	3	
Williams	29.3	...	...	65	26	.....	28	65	.28	.12	T	NW	12	7	11	4	
Wilton	32.8	41.3	24.3	59	26	5	19	54	1.29	1.29	T	W	16	14	..	1	
Winterset	33.4	42.6	24.1	65	26	1	19	64	.50	.36	....	NW	9	10	14	2	
Average for State	32.7	42.2	22.8	72	15	-5	19	....	.92	....	....	NW	10.4	10.6	9.5	3.7	

STATIONS.	DATE.																																		Monthly Mean.
	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th.	27th.	28th.	29th.	30th.					
Afton	42	36	43	48	36	36	42	35	34	24	22	38	39	38	54	42	28	52	18	38	34	36	35	34	40	44	33	16	28	32	35				
Algona	38	38	45	38	30	34	40	34	26	21	20	36	36	41	40	18	26	11	14	25	25	28	34	32	34	40	17	16	47	28	29.6				
Alta	37	34	43	42	34	36	42	32	24	20	16	36	37	39	46	19	22	11	13	36	21	30	34	30	38	47	20	11	26	25	30.1				
Amana	40	39	42	50	34	31	38	37	30	25	19	32	39	36	52	22	20	29	12	35	23	40	33	32	36	46	28	16	33	32	32.1				
Ames	40	39	44	46	36	32	41	36	28	...	...	36	34	...	54	22	20	27	10	37	20	...	33	31	...	...	28	12	33	30	31.2				
Atlantic	40	34	42	44	36	36	45	38	27	26	18	40	37	37	48	22	22	22	17	39	24	32	30	30	38	47	30	16	37	25	32.2				
Atlantic (near)	40	36	44	45	34	37	45	36	33	32	18	40	40	40	51	31	24	24	17	37	35	37	34	32	46	50	34	16	38	18	34.0				
Audubon	40	36	38	46	36	36	45	36	28	22	18	39	38	40	48	26	23	15	38	24	35	34	38	42	38	49	30	19	28	28	33.8				
Belle Plaine	42	41	43	40	42	42	43	34	30	20	18	35	36	36	51	24	20	27	12	34	23	38	33	34	33	47	28	14	38	30	32.2				
Bonaparte	42	44	42	46	36	32	38	38	35	27	22	36	42	39	54	33	22	32	14	37	28	45	36	34	37	48	35	18	36	34	35.1				
Carroll	36	39	43	42	36	35	42	36	26	18	18	38	37	34	48	20	21	22	17	38	26	27	28	34	36	45	26	18	39	30	31.7				
Cedar Falls	45	42	45	44	38	31	38	39	28	21	18	38	37	34	46	21	20	29	13	38	22	34	29	30	32	46	20	12	21	30	31.1				
Cedar Rapids	44	41	44	46	36	34	39	38	31	28	21	34	38	38	51	25	24	30	16	35	28	40	36	35	35	45	32	21	26	30	34.0				
Charles City	34	36	39	37	32	28	34	32	26	26	14	28	32	33	44	26	20	26	6	37	17	30	28	30	28	38	26	23	24	30	28.8				
Clarinda	43	37	44	46	38	38	44	34	31	22	20	44	40	44	52	26	23	24	19	40	28	37	34	34	42	50	30	18	29	31	34.7				
Clinton	40	44	42	43	36	34	37	37	34	28	20	28	34	36	52	34	22	33	16	36	24	40	35	33	32	45	30	17	24	32	33.2				
College Springs	44	39	46	42	42	41	46	40	32	25	22	42	36	42	55	31	24	25	18	38	30	34	36	44	45	50	38	25	33	32	36.6				
Corning	42	40	44	46	42	36	46	37	34	25	19	41	40	40	55	33	26	30	16	42	26	40	33	33	41	52	37	18	28	30	35.6				
Cresco	38	36	39	41	30	30	32	32	27	18	15	28	31	33	44	20	19	18	8	34	18	30	29	28	30	44	18	8	20	30	27.5				
Davenport	44	39	44	46	35	33	37	36	31	28	21	29	36	38	54	28	24	35	14	36	26	41	36	36	37	50	32	18	26	33	34.0				
Decorah	40	38	44	42	34	31	34	34	30	24	16	27	34	34	29	30	20	24	9	34	24	30	33	31	28	44	34	12	21	30	30.0				
Delaware	40	38	38	40	31	30	34	35	28	24	16	38	33	34	42	24	20	24	10	39	20	33	28	29	28	40	32	12	25	30	29.2				
Des Moines	43	40	46	48	38	35	44	38	30	26	19	38	40	40	54	26	23	28	14	38	26	36	36	34	40	51	31	16	26	32	34.5				
Dubuque	48	42	43	44	38	34	34	35	32	28	24	26	33	34	54	36	23	33	15	36	20	21	35	34	27	47	36	15	23	31	33.2				
Elkader	40	38	42	42	33	31	34	36	29	22	17	36	32	34	46	22	20	26	10	37	24	34	32	32	28	45	24	12	21	30	29.9				
Emmetsburg	35	36	42	42	34	33	40	32	26	20	15	35	34	39	40	20	22	12	10	34	19	36	32	31	32	47	26	11	26	33	29.0				
Fairfield	42	...	42	46	34	31	38	38	35	28	18	37	40	36	53	34	20	34	16	36	25	40	34	31	34	46	34	16	35	33	33.8				
Forest City	...	...	...	...	37	34	38	30	20	14	30	33	36	38	31	14	23	8	16	30	26	24	32	27	32	39	12	13	33	26	26.0				
Ft. Madison	44	44	46	44	38	35	41	37	35	31	25	34	42	42	54	27	28	36	20	44	35	46	44	38	37	51	57	24	38	37	37.6				
Galva	37	36	38	46	39	36	43	34	41	21	21	36	33	36	51	29	23	24	14	38	28	30	33	31	36	42	26	12	24	32	32.0				
Glenwood	48	46	46	45	37	42	46	32	29	23	19	50	42	48	47	30	24	22	24	38	27	35	35	34	40	49	36	14	...	27	35.0				
Grand Meadow	40	35	42	35	32	30	32	34	31	21	20	30	32	36	44	22	22	22	12	30	23	34	34	32	32	37	21	14	24	31	29.9				
Greenfield	40	38	43	40	34	40	48	36	32	25	20	38	40	42	50	24	23	22	16	39	25	37	34	32	40	50	28	16	27	30	33.6				
Grinnell	41	42	44	46	35	33	40	35	32	26	20	38	39	38	50	32	22	27	16	39	25	34	36	32	34	46	34	18	26	30	33.6				
Grundy Center	41	36	47	38	32	35	40	29	28	16	25	36	34	44	39	17	22	18	18	32	28	31	34	28	40	43	18	18	32	31	31.0				
Hampton	37	38	42	42	36	35	38	34	25	18	16	39	36	37	44	19	20	16	6	34	20	30	32	28	30	45	20	10	20	29	29.1				
Hopeville	42	38	43	46	36	36	46	36	33	23	18	40	41	38	53	29	22	33	12	40	25	38	34	39	34	46	30	14	26	33	34.5				
Hopkinton	42	38	42	45	35	32	36	35	28	26	17	30	35	37	50	26	19	28	15	36	31	40	30	29	32	44	28	14	21	32	31.8				
Independence	44	40	38	44	34	30	36	35	32	27	16	38	30	36	46	30	19	28	15	36	31	39	32	30	35	50	38	20	34	32	33.2				
Indianola	36	42	44	40	42	35	...	...	29	22	16	38	40	40	54	38	22	32	16	33	32	32	32	32	36	44	34	16	32	30	34.0				
Iowa City	40	42	44	47	40	31	38	38	34	28	22	30	38	36	52	36	23	32	18	35	30	39	36	32	36	44	34	16	24	30	34.0				
Iowa Falls	38	39	42	42	32	30	40	35	28	19	16	32	36	45	...	20	19	14	8	35	20	32	32	30	36	46	20	10	22	28	28.9				
Keokuk	49	40	45	47	37	32	40	39	38	29	22	36	42	40	58	38	25	38	16	40	30	49	40	37	40	52	36	22	28	34	37.0				
Keosauqua	44	46	46	47	40	33	40	40	30	30	24	36	34	40	56	38	26	29	16	38	32	45	40	38	38	52	40	18	26	30	37.2				
Knoxville	44	45	38	44	31	35	41	43	32	26	21	37	40	38	48	26	22	29	16	28	24	42	35	38	38	63	34	18	29	32	34.5				
La Crosse (Wis.)	43	38	41	42	34	30	32	34	31	22	17	28	34	36	46	33	24	24	10	32	20	29	34	32	30	44	24	12	24	26	30.0				
Larrabee	40	35	44	40	34	37	42	34	30	20	15	35	38	40	44	26	24	18	12	32	20	29	33	28	34	46	21	10	24	26	30.4				
Logan	40	40	43	37	36	36	47	36	26	25	20	45	44	51	25	22	26	28	18	32	24	30	35	25	40	47	25	22	24	35	32.3				
Mason City	34	36	40	42	28	28	37	36	26	22	14	28	30	35	43	22	14	6	6	33	22	30	30	28	26	44	30	9	26	28	27.6				
Mechanicsville	41	38	43	39	33	27	34	36	30	27	20	37	34	36	44	28	22	24	12	32	22	38	33	32	33	39	30	14	22	26	30.9				
Monticello	45	38	41	41	31	32	35	36	30	22	19	30	32	36	42	22	24	24	15	33	26	38	31	31	32	42	22	15	27	31	30.7				
Mt. Vernon	44	40	44	44	34	34	38	38	28	21	22	32	34	40	48	20	24	27	13	32	27	38	34	32	38	45	23	15	28	33	32.3				
Newton	42	41	44	47	35	32	41	39	34	25	18	36	39	39	52	34	21	24	10	37	22	36	31	32	35	47	34	14	24	30	33.2				
Ogden	40	39	42	46	35	33	40	35	32	25	15	38	36	39	48	26	20	14	10	38	16	33	33	30	32	50	27	12	22	30	31.1				
Omaha (Neb.)	42	40	48	50	39	42	48	41	29	23	24	46	42	46	52	26	28	27	23	43	30	38	38	38	44	52	34	19	30	28	37.1				
Osage	36	38	38	36	28	28	34	34	26	20	14	32	33	36	40	17	18	8	8	36	20	26	32	28	28	36	19	9	26	32	26.7				
Osceola	40	37	42	46	34	36	42	36	28	23	20	37	26	38	53	38	26	30	20	42	26	32	30	35	38	48	32	16	28	33	33.9				
Oskaloosa	41	42	45	48	34	34	40	38	32	24	20	37	39	38	46	32	26	26	12	35	24	39	46	32	36	48	35	17	26	32	34.2				
Ottumwa	42	43	46	46	42	34	40	38	36	26	20	38	40	40	56	34	24	30	14	35	27	42	38	35	38	51	34	18	27	34	36.4				
Ovid	42	38	44	46	37	36	44	36	34	24	20	44	38	39	54	32	23	28	16	40	26	42	37	35	42	52	32	18	27	33	34.8				
Richland	46	40	46	39	36	35	40	40	32	24	23	43	38	36	43	22	26	25	20	34	28	40	36	36	36	41	28	20	30	35	33.9				
Rock Rapids	39	40	40	41	38	38	46	37	28	14	18	30	40	38	48	32	20	21	22	24	22	28	29	34	41	46	29	20	26	31	31.5				
Rockwell City	36	34	44	38	34	36	42	32	25	16	23	40	36	35	30	24	23	12	21	32	22	24	28	29	34	38	50	19	24	27	26	30.1				
Sac City	38	40	38	38	36	38	42	38	26	20	16	36	40	40	44	18	19	24	14	24	25	28	28	32	40	38	33	14	28	28	30.7				
Seymour	43	42	44	46	40	34	42	40	34	29	18	36	38	38	52	22	22	30	16	38	32	41	35	33	47	53	39	16	22	28	35.5				
Sibley	37	36	43	47	42	35	38	34	30	18	15	34	36	38	42	37	24	18	11	33	17	31	30	30	31	44	32	10	26	25	30.4				
Sioux City	38	38	46	46	37	39	46	36	26	22	20	44	40	43	45	22	26	19	19	37	24	32	37	34	37	50	26	16	32	28	33.0				
Spirit Lake	37	42	42	36	34	40	32	34	23	14	34	35	36	...	...	27	...	27	16	...	28	32	30	30	34	45	24	8	26	26	29.4				
Unionville (Mo.)	43	40	39	43	44	44	57	36	32	27	38	33	41	36	47	20	18	29	13	24	19	31	20	23	34	36	31	22	28	32	33.0				
Villisca	42	38	43	46	36	36	46	34	30	23	18	43	40	42	52	22	24	26	18	42	27	34	34	33	39	48	34	19	28	30	34.2				
Vinton	43	40	43	42	32	32	35	36	30	22	21	34	33	39	47	20	29	21	14	34	26	36	34	32	32	44	22	15	27	32	31.5				
Washington	41	40	40	45	34	31	38	37	30	25	20	34	38	38	54	22	22	26	14	40	24	10	36	32	35	48	30	16	24	32	33.0				
Waukee	42	40	43	52	38	38	42	42	34	28	16	36	42	40	66	34	24	30	15	40	36	35	36	34	38	49	42	18	26	32	36.9				
Webster City	37	37	36	38	30	37	38	34	28	24	23	32	35	42	40	18	20	12	17	34	34	28	32	28	36	40	18	10	26	30	30.0				
Williams	39	37	10	37	32	32	39	37	25	24	20	34	35	40	40	19	24	12	14	30	26	28	32	28	34	38	18	10	26	30	29.3				
Wilton Junction	40	38	40	42	34	32	37	37	30	28	19	30	37	35	38	24	20	33	19	43	30	40	33	32	35	36	35	18	23	32	32.8				
Winterset	35	37	42	47	35	36	42	35	28	23	18	38	36	39	53	25	21	31	13	49	25	35	33	34	39	50	33	15	25	30	33.4				

MAXIMUM AND MINIMUM TEMPERATURE FOR NOVEMBER, 1894.

| STATIONS. | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | | 9 | | 10 | | 11 | | 12 | | 13 | | 14 | | 15 | | 16 | | 17 | | 18 | | 19 | | 20 | | 21 | | 22 | | 23 | | 24 | | 25 | | 26 | | 27 | | 28 | | 29 | | 30 | | Mon'y Mean. | |
|---|---|---

STATIONS.	DATE.																															Total.
	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	26th	27th.	28th.	29th.	30th.	
Afton	..	.44	...	...	...	...	.14	...	...	...	...	...	T	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	T	...	.58
Algona	...	T	...	...	...	...	T	T	T	...	T	.17	T	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.17
Alta	.03	T	...	.02	...	...	.14	...	T	.02	...	.01	.03	...	...	...	...	...	.01	...	...	...	...	...	...	...	...	...	...	...	.26
Amana	..	1.60	...	...	...	...	.04	...	...	T	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1.64
Ames (I. A. C.)	.25	...	...	...	...	.06	.06	...	...	...	...	...	.05	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.03	...	...	.45
Ames (Experiment Station)	.24	...	...	...	...	.04	.09	T	...	...	...	.03	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.10	...	.50
Atlantic (near)	.15	..	...	...	...	...	.09	.02	...	T	T	...	T	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.05	...	.31
Atlantic	..	.07	...	...	...	...	.13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	T	...	.20
Belle Plaine	T	.80	...	...	...	...	.05	...	...	...	...	...	.02	...	...	...	...	...	...	...	...	...	...	...	...	...	.02	...	...	.28	1.11
Bonaparte	1.00	.18	...	.02	...	...	.13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.25	.22		1.86
Carroll	...	...	...	.06	...	...	.11	...	T	T	...	T	.11	...	...	...	...	...	.01	...	...	...	...	...	...	...	...	...	...	...	.29
Cedar Falls	.48	...	...	...	...	...	...	...	...	...	...	.50	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.98
Cedar Rapids	...	1.44	...	...	...	...	T	03	...	...	...	...	04	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	T	.02	1.53
Charles City	.04	.60	...	...	...	...	...	...	...	...	...	.38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	T	...	1.02
Clarinda	.31	...	...	T	...	...	.15	...	...	...	...	T	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.09	...	...	...	.55
Clinton	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1.75
College Springs	.30	T	...	T	...	...	T	...	...	...	...	...	T	...	...	...	...	...	...	...	...	...	...	...	...	...	...	T	.15	.45
Corning	.40	...	...	T	...	...	.25	...	...	...	...	...	T	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.20	...	...	.85
Cresco	...	.46	...	...	...	.06	...	...	.08	...	...	.30	...	...	...	...	...	...	...	...	T	...	...	...	...	...	...	...	...	...	.90
Davenport	...	1.10	T	...	...	...	.02	.02	.04	.03	T	.03	T	...	...	T	...	...	...	...	...	...	...	...	...	...	...	.02	T	...	1.26
Decorah	..	.46	...	...	...	...	.05	...	.20	...	...	.27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.98
Delaware	.25	.86	...	...	...	...	...	...	.13	...	...	.33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.16	...	...	1.73
Des Moines	.10	.22	...	T	...	...	.06	.01	..	T	...	T	.07	...	...	T	T	...	T	...	...	...	...	...	...	...	...	.49	.04	...	.9
Dubuque	..	1.40	...	...	...	...	.05	T	.05	T	...	.03	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	T	T	...	1.53
Elkader	.02	.96	...	...	...	...	.01	..	.12	..	...	.41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1.55
Emmetsburg	.14	...	...	...	...	...	.11	...	...	...	...	.17	.01	...	...	...	...	T	...	...	...	...	...	...	...	...	...	...	...	...	.43
Fairfield	...	1.48	...	.12	...	...	.04	.02	.02	...	...	T	T	...	...	...	...	...	...	...	...	...	...	...	...	...	...	T	.08	...	1.66
Forest City	...	...	...	...	...	...	...	...	T	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	(?)
Fort Madison	...	.92	...	...	...	...	.26	..	..	T	T	T	...	...	...	T	...	...	...	...	...	...	...	...	...	...	...	.69	.22	...	2.09
Galva	..	T	...	...	...	...	.08	...	...	...	T	...	.11	...	...	...	...	.02	...	...	...	...	...	...	...	...	...	...	...	...	.21
Glenwood	.01	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.01
Grand Meadow	...	.61	...	...	...	...	.10	...	.35	.02	...	.36	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	T	...	...	1.43
Greenfield	35	...	...	...	...	...	.15	...	...	...	...	T	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.01	T	.02	...	.53
Grinnell	.20	.50	..	T	...	T	.20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.10	.15	...	1.15
Grundy Center	0.40	..	...	...	...	...	.07	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.47
Hampton	.18	...	...	...	...	...	.13	...	...	...	...	.10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.41
Hawkeye	...	.51	...	...	...	...	.06	...	...	...	...	.78	...	...	...	...	...	...	...	...	...	.03	...	...	...	...	T	T	...	...	1.38
Hopeville	.92	05	...	T	...	...	.16	...	...	T	...	...	.02	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.01	.03	...	1.19
Hopkinton	...	1.35	...	..	...	...	...	...	...	.10	...	.15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1.60
Humboldt	..	...	...	...	...	...	.07	.02	...	...	...	.10	.03	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.22
Independence	...	1.00	...	...	...	...	...	...	...	.10	...	.15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.01	...	...	1.11
Indianola	T	.50	...	...	...	...	...	...	.20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.13	...	.83
Iowa City	...	1.62	...	...	...	...	T	T	...	...	...	T	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	T	.18	...	1.80
Iowa Falls	..	...	...	...	...	...	...	.05	...	.05	...	.15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.25
Keokuk	.01	1.01	...	.08	...	...	.18	...	...	T	...	...	...	...	...	...	...	T	...	...	...	...	...	...	...	...	...	.28	.58	...	2.24
Keosauqua	...	1.12	...	T	...	...	.14	...	...	T	...	...	...	...	...	T	...	...	...	...	...	...	...	...	...	...	...	.07	.08	...	1.41
Knoxville	...	.81	...	...	...	...	.15	...	...	T	...	...	T	...	...	T	...	...	T	...	...	...	...	...	...	...	...	T	T	...	.96
La Crosse, Wis	...	.57	T	T	...	...	.20	01	.15	.02	...	.12	.08	...	T	T	...	T	...	...	T	T	...	...	...	...	...	...	...	...	1.15
Larrabee	.25	...	...	T	...	...	.06	T	...	T	T	.06	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	T	...	.37
Le Claire	...	.85	.41	...	...	...	.02	09	.04	.02	...	.02	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.01	.02	...	1.48
Mason City	...	.06	...	.03	...	...	.03	...	.05	...	...	.16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.33
Mechanicsville	...	15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.01	...	...	...	...	...	...	...	...	...	...	.02	...	...	.18
Monticello	...	1.73	.01	...	...	...	.02	...	.06	T	...	.17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.05	...	...	2.03
Newton	.17	.46	...	T	...	...	.06	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.13	T	...	.82
North McGregor	...	.70	.06	...	...	...	.07	.01	.06	...	...	.18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.03	...	...	1.11
Ogden	...	.09	...	...	...	...	.07	...	...	...	...	...	.09	...	...	...	...	...	.01	...	...	...	...	...	...	...	...	...	...	...	.26
Omaha, Neb	T	...	...	T	...	...	.10	...	...	T	...	...	T	...	...	T	...	...	...	...	...	...	...	...	...	...	...	...	...	.01	.11
Osage	...	.26	...	...	...	...	.05	...	...	...	...	.39	...	...	T	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.70
Osceola	1.00	...	...	T	...	...	.16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.12	...	1.28
Oskaloosa	...	1.37	...	...	...	...	05	...	...	...	...	...	...	...	.02	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1.44
Ottumwa	.62	.88	...	T	...	...	.12	.03	T	T	...	...	T	...	...	T	...	...	...	...	...	...	...	...	...	...	...	T	T	...	1.65
Ovid	1.21	...	...	.08	...	...	.21	...	...	...	...	...	.12	...	...	T	...	...	...	...	...	...	...	...	...	...	...	...	.08	...	1.70
Richland	...	1.45	...	T	...	...	.11	...	...	...	...	...	...	...	...	T	...	...	...	...	...	...	...	...	...	...	...	.02	T	...	1.58
Rockwell City	...	...	...	...	...	...	.11	...	T	T	...	T	...	...	...	...	...	...	T	...	...	...	...	...	...	...	...	...	...	...	.11
Rock Rapids	...	...	...	...	...	T	T	...	...	...	...	T	T	T	...	...	...	T	...	...	...	...	...	...	...	...	...	...	...	...	...
Sac City	...	...	...	T	...	...	10	...	...	.10	T	T	T	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.20
Seymour	.25	1.60	...	.35	...	...	.22	T	...	...	...	...	T	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2.42
Sibley	T	.09	...	...	...	...	.09	...	T	...	...	T	.11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.29
Sioux City	.09	.01	...	.01	...	...	.03	...	...	T	T	T	.03	...	T	...	...	...	T	...	...	...	...	...	...	...	...	...	...	...	.17
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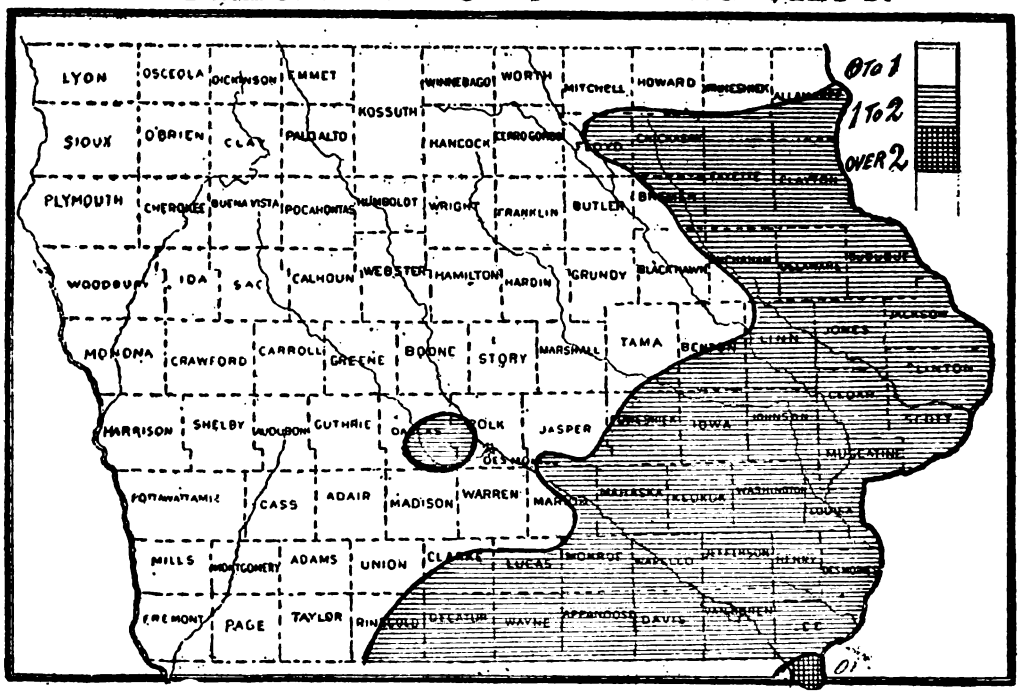
PRECIPITATION CHART NOV, 1894.



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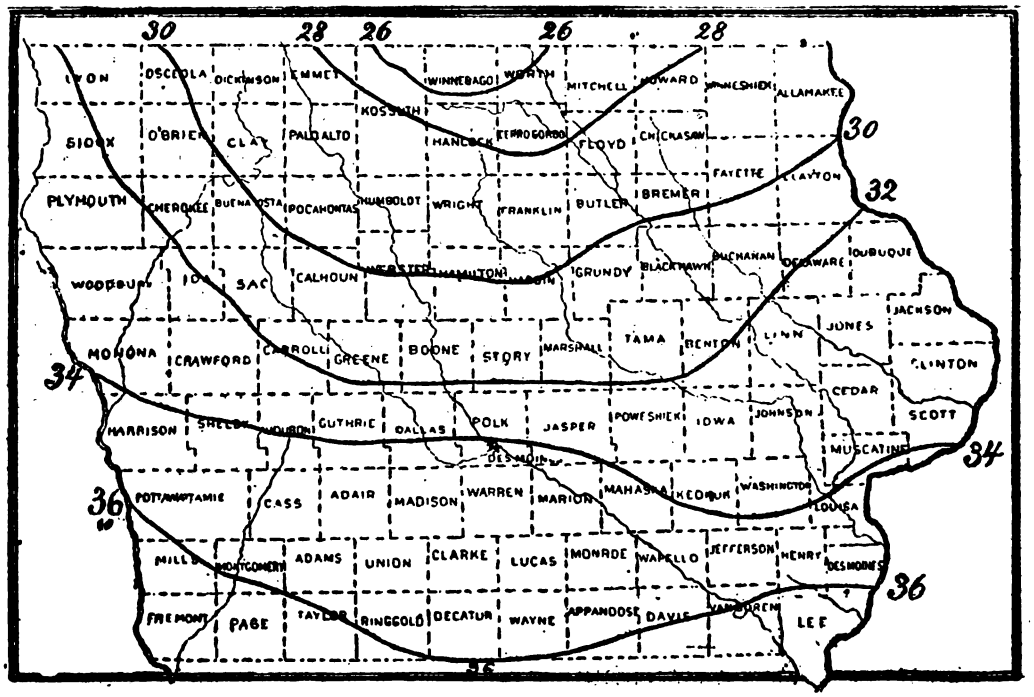

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Tama	W. G. Malin.
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UNITED STATES DEPARTMENT OF AGRICULTURE
WEATHER BUREAU.

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MONTHLY REVIEW

OF THE

Iowa Weather and Crop Service.

VOL. V.—DECEMBER, 1894.—NO. 12.

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LOCAL FORECAST OFFICIAL,
U. S. WEATHER BUREAU, ASS'T DIRECTOR.

DES MOINES:
F. R. CONAWAY, STATE PRINTER.
1895.

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U. S. Department of Agriculture---Weather Bureau.

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MONTHLY REVIEW

—OF THE—

IOWA WEATHER AND CROP SERVICE.

VOL. V.] DECEMBER, 1894. [NO. 12.

EDITORIAL NOTES.

Europe has "enjoyed" the butt cut of winter thus far this season. Very severe storms with heavy winds and snows have prevailed in the United Kingdom and portions of the continent.

* * *

According to the statement of Superintendent Sabin there are in Iowa 697,228 children of school age—a gain of 10,073 during the year ending October 1, 1894. In all estimates these should be rated as the foremost product of the State.

* * *

The period of sun-spot maxima was reached two years ago, and solar disturbances will gradually become less intense and less frequent. So if it is true, as some maintain, that sun-spots cause abnormal weather conditions, we may look for the gradual return of our normal seasons.

* * *

In a careful investigation by two Italian meteorologists, it has been found that a veil of cirrus clouds absorbs as much as 30 per cent of the sun's rays, while a slight fog, equally diffused in all directions, may intercept from 58 to 92 per cent of the solar rays that would be transmitted with a clear sky.

* * *

Reports indicate that threshing corn is the most economical and profitable method of separating the grain from the stalks. The threshing machine is equal to a shredder, leaving the stover in excellent condition for housing, stacking, feeding or baling. It utilizes the entire crop and saves the disagreeable work of husking by hand.

* * *

Aerated bread, or bread raised by using water charged with carbon dioxide instead of by yeast, was devised by a Scotch physician in 1859, and is said to have been popular in England for a score of years, although attempts to introduce it into America have utterly failed. In London alone eighty-three stores, with over 1,000 operatives, supply it.

* * *

The publication of the December number of the MONTHLY REVIEW has been unavoidably delayed by the installation of a new state printer, involving some of the ordinary mishaps incident to the fitting up of a new printing office of sufficient size to do the work in that line for a great state like Iowa. Mr. Conaway will soon be in a position to execute all orders for the public printing with neatness and dispatch.

* * *

The cold wave which swept down from the northwest December 27th and 28th, with an excessively high barometric pressure, carried freezing temperature to the Gulf of Mexico, extending even to the Indian river country in Florida. The damage to oranges and other fruits of that region amounted to millions of dollars. It was said to be the coldest weather experienced in that section within the past sixty years. The pressure in the northwest was over 31.20 inches.

* * *

The mined products of California, it is said, amount to twenty million dollars a year. That handsome output of precious metals gives it the name of the "Golden State." And yet, in this year of unprecedented shrinkage from the effects of drouth, the oats crop of Iowa was worth $26,000,000, the corn crop $36,000,000, the hay crop $21,000,000 and the pasturage $20,000,000. The total output of Iowa soil this dry year is worth six times the yearly average of California's precious metals.

* * *

The U. S. Department of Agriculture has published tables, furnished by U. S. Consul Lathrop at Bristol, England, giving information relative to the importation of corn into the United Kingdom, France, Germany, Belgium, Holland, Denmark, Switzerland and Austria-Hungary during the fiscal year ending July 31, 1894. These countries imported over 134,000,000 bushels of corn. Of this amount the United Kingdom took over 70,000,000 and Germany 33,000,000 bushels; France took 10,500,000, and Holland and Austria-Hungary each 6,500,000; Belgium took nearly 5,000,000, and Denmark and Switzerland nearly 1,750,000 bushels each. The bulk of the corn imported into the United Kingdom comes from Roumania and the United States, but Russia, Canada and Turkey, in the order named, are drawn upon to make up about a fourth of the supply. Nearly half of that imported into Germany comes from the United States. America furnishes not more than a fifth of the French supply. In supplying Holland, America is slightly in the lead. The figures

show a marked increase over the previous year. One of the features shown by the tables of special interest to our own farmers is that, while Argentine has been cutting a wide swath in the international wheat market, her exports of corn to European countries have fallen off greatly. They aggregated nearly 11,000,000 bushels in 1893, and less than 2,000,000 in 1894. It will occasion surprise to some Americans that the little kingdom of Roumania furnished the principal corn importing countries of Europe more corn than the United States. Roumania supplied 48,000,000 bushels and the United States 46,000,000 in the year 1894.

***

The Anamosa *Journal* quotes one of the most prosperous farmers of Jones county as saying: "The substitution of cornstalk fodder for hay is a fixed fact. It has become a permanent feature of Iowa farming. Corn fodder saves all the hay. It will be unnecessary for the farmer to cut hay, and this will increase the value of the summer pastures. There will be more grass during the warm season, and corn, oats and straw will supply the needs of winter. The horses will eat straw and oats, the cattle will consume the cornstalks."

***

Ice, transmits both heat and light without being melted. A lens made of clear ice may be used to light a fire. Dr. Sutherland, in "Observations Upon the Icebergs of Baffin's Bay," says: "Several pieces of granite were found deeply imbedded in ice, without any communication with outside air. These were surrounded with what might be termed an atmosphere of water." The explanation of this phenomenon is that the rays of light, passing through the ice, conveyed heat which was absorbed by the stones in sufficient quantity to melt the ice around them.

DRAINAGE AND ITS EFFECT ON SOIL AND CLIMATE.*

There is no question among successful and progressive farmers as to utility of the artificial drainage of all lands that are not favored by natural drainage. In this State it has reclaimed and made arable and productive hundreds of thousands of acres of lands that were formerly comparatively worthless, covered by stagnant pools and miasmatic bogs. These contain the deepest and richest deposits of the elements of crop production, and when thoroughly drained are the most valuable lands in the State.

The effect of tile-drainage upon the soil is to make it warmer, more porous, and better able to withstand the extremes of wet or dry seasons. The water is more quickly removed from the surface, where it may become harmful, and is absorbed by the sub-soil, where it is made available for plant growth. As to this matter there ought to be no occasion for controversy among well-read and experienced farmers, and the only question for discussion should be that relating to the best methods of drainage, to secure therefrom the best results.

But of late a new issue has been raised, and many are now gravely asking if these tile-drained and reclaimed lands have not been purchased at an excessive price. In other words they are inquiring if by this extensive drainage of ponds and wet lands we have not ruined our climate. If that is true, if it can be demonstrated that drainage of the soil is the direct or indirect cause of our occasional destructive drouths, then the evil effects greatly exceed all incidental benefits, and we should at once plug up our tile-drains and set to work to restore the old-time sloughs and frog ponds. Certainly we had better cultivate only the dry ridges, and convert the bottoms and vales into lakes or quagmires, if that is the only method whereby we can save the State from becoming a desert.

Let us, however, not condemn hastily, without a hearing or the benefit of argument. Possibly we shall find, upon a careful investigation of the facts in the case, that the alleged cause of our destructive drouths is wholly inadequate to produce such a tremendous and widespread effect upon the climate of this region.

And that is the plea which may be entered in defense of drainage, that it is too small and insignificant in itself to produce so great a result. The simple little earthern tubes, when placed in the ground at proper depth, may be able to warm the soil, and make it more friable and productive, but we may not therefore assume that they possess sufficient potency to control the sweep of atmospheric currents and change the climate of an entire continent. The means is wholly inadequate to produce so vast a result—somewhat like the attempt of Mrs. Partington to sweep back with her broom the tides of the ocean.

The total area of drained lands in this State is relatively very small. Probably it does not exceed five per cent of the farmed lands, or about 1,500,000 acres. Is it credible that this five per cent, if it had remained wet and soggy, would have been sufficient to furnish vapor to condense into rainfall to amply irrigate the 95 per cent of dry lands?

The great drouth of 1894 was altogether too big a thing to be accounted for by this hypothesis. The drouth began in the midsummer of 1893, the records showing a deficiency of 6.00 inches in the rainfall of the last six months of that year. For the year 1894 the average rainfall for this State was about 13.00 inches below the normal amount, making a total shortage of 19.00 inches of water for that year and a half.

Did you ever figure up the vast amount of water that would be required to fill that deficiency? To furnish that amount by local evaporation or irrigation would require a reservoir or lake 110 miles long, 50 miles wide, and 16 feet deep. It would make a river one mile wide, 16 feet deep, and 5,500 miles in length. The great Mississippi river, from its source to its mouth, at its average stage, would not contain that amount of water.

These figures represent merely the *deficiency* of our rainfall during the late drouthy period. But to represent our average or normal rainfall for the same time, we must increase the capacity of our suppositious channel or reservoir a little more than two and a half times, making it 43 feet instead of 16 feet in depth.

Would it not require a pretty extensive area of ponds and sloughs to make enough vapor to be condensed into rainfall of sufficient amount to fill that vast chasm? A bare statement of the question in this form affords a sufficient refutation of that theory.

The truth is, this region does not depend upon evaporation from the surface of its lakes, rivers and sloughs to supply its normal quota of moisture. If it did, this great fertile valley would soon become in fact as it was at one time in name—"The Great American Desert." Every drop of rainfall upon our fields, and every grain of vapor in the air, come primarily from the sea, and in the order of nature every drop must find its way back to the source whence it came.

The surface of the globe is about three-fourths water and one-fourth land. The continents are irrigated by nature's dual process of evaporation and precipitation, and all the water they receive comes from the ocean. From the effects of great heat in the tropical zone, and the earth's motion, the waters of the ocean are kept moving in mighty currents or rivers, carrying some measure of the warmth and moisture of the tropics through the temperate and into the arctic region. The atmospheric currents and eddies perform a similar office in this distribution of a portion of the surplus heat and humidity of the great equatorial belt. And the amount of moisture which any portion of a continent receives depends upon its general topography, and its favorable or unfavorable location near the pathway of the great air currents which are laden with moisture. In the distribution of rainfall over this continent the great mountain ranges bear an important part, by deflectig or uplifting the humid winds.

In this Upper Mississippi valley it is probable that 98 per cent of our annual rainfall comes from the Gulf of Mexico. The remaining two per cent may reach us from the Pacific, borne hither on the wings of the cyclones which sweep down from the northwest. The great interior lakes and the larger rivers of the continent are fed by humid air currents from the Gulf and oceans. Taking this enlarged view of the question, we may see the utter folly of the charge that our poor innocent little drainage system has ruined the climate by drying up the sources of rain-production.

And upon reflection we shall see that it will not do to build any hypothesis upon the basis of a single season, or even upon a short series of years. It will take a good many dry years to convince me that this fertile valley has reached its maximum of production, and is liable to become as arid as the deserts of Asia.

During my residence in Iowa, covering a period of twenty six years, I cannot recall more than four seasons of severe drouth which seriously affected the crops in the larger part of the State. There have been in other years local drouths, of short duration and extent, but the general drouths which have materially reduced the total crop output of the State, have been few and far between—not more frequent, in fact, than in the eastern and middle States. The great drouth of '93 and '94 was by far more severe and extensive than any that has been noted since '46, '54, and some time in the '60s. Those early drouths were not so damaging as the one just experienced, because there was not so large an area of crops to be damaged.

Another fact of observation, during the past quarter of a century in Iowa, is that in the long run more damage has been done to crops by excessive rainfall in the season of planting, cultivating and harvesting than has resulted from extremely dry weather. Of the two extremes—very wet or very dry—the farmer has good reason to choose the latter.

The average yearly rainfall in Iowa is 35 inches. A little more than two-thirds of this amount usually falls in the six crop months—April 1 to October 1—and on an average we get 13 inches of water in the three summer months. In the distribution of these watery blessings there is considerable variability, and while one portion of the State is drenched another part may be needing moisture. It sometimes happens that the greater portion of our seasonal rainfall comes in the planting and cultivating time, and when that occurs we hear no fault found with our drainage system, except that there is not enough of it. In such seasons of excess both the earth and air are reeking with surplus moisture. The oats, barley and other cereal crops grow rank and are flattened to the ground by heavy storms. The corn fields are but sparsely cultivated, and go to grass and weeds. The meadows and pastures thrive apparently, but even the grass is lacking in the essential quality of nutriment. And one of the worst effects of these too frequent wet seasons is the generation and spread of rusts, blights, mildews, and all forms of fungous diseases of plants. These fungous pests and parasites cannot thrive in a very dry climate, nor in a drouthy season.

Nature has most bountifully provided for this portion of the Mississippi valley. The average spring and summer rainfall would be greatly in excess of our needs, and detrimental, but for the fact that our prairies are rolling, our natural surface drainage more excellent, and our soil, subsoil and underlying strata are porous, serving as capacious reservoirs for the storage of surplus moisture. So nature has done its best to drain off and dispose of surface water, and our farmers have wisely followed the example by ditching and tile-drainage.

In fact, mankind have made some improvements upon nature's work, and that is what they are here for. In its original condition, as left by nature and the Indians and buffaloes, the surface of this State was composed of dry ridges and divides and innumerable depressions, in which were streams flowing sluggishly through miry and well-nigh impassable bottoms. On many of the divides there were numerous small lakes, ponds and extended bogs, evidently of glacial origin.

Now to make this a great and productive commonwealth it became necessary first to break up and cultivate the dry lands, and then so far as practicable to drain off stagnant waters and extend the area of arable lands. This drainage of the surplus water was a necessity, because you cannot successfully raise corn, clover, frogs and bullheads on the same soil at the same time. So as a matter of course, and of necessity, we have very materially reduced and drained off the original area of wet, cold, miry and malarious lands in this State; and it was the best and wisest thing to do. And in doing it we have not ruined our climate, nor lessened the amount of rainfall in any degree whatever. We have simply *begun* work in that line, and when our drainage system is complete we shall be able to raise an abundance in this State, for our soil will be better able to withstand extremes of wet or dry.

While we may stoutly maintain that cultivation and drainage have not in the least affected the climate nor lessened the humidity or rainfall, yet it is quite evident that by

the work of man the amount of water surface has been diminished, and the subterranean water-level has been materially lowered. In the early days shallow wells were the rule, and deep wells exceptions. In late years our farmers have been in sore straits to secure water for their stock. In some sections the stock-water problem is most serious and perplexing. Why are our wells giving out, and why is the water-level becoming lower? What has become of the old-time ponds and streams?

The question is quite easy of solution. The surface of the original prairies and divides was hard and measurably impervious, so that the rainfall ran off rapidly into the depressions, sloughs and streams. The native prairie grasses and weeds were shallow-rooted, and the original turf was incapable of retaining moisture. The ponds were filled because the ridges soon ran dry. But now these conditions are changed. The hard, impervious turf has been broken, and the soil has been made friable and porous by cultivation. The ponds and sloughs have been measurably dried out by plowing and working the fields, making the soil of the ridges and divides more receptive and retentive of moisture.

And to a still greater extent we have used up our water supply by the growing of immense crops in place of the scanty herbage of the old time. We have made ten blades of grass or corn or grain to grow where one poor little wiry juiceless blade grew in former days. And so it requires billions of tons more water to supply the demands of plant growth in these days than in the time when the Indian and buffalo trails were still visible on our prairies.

The quantity of water absorbed by vegetation has been made a matter of study and experiment by investigators in this country and in Europe. The results show that where the watersheds are densely covered with grasses or the cereals, there is but little water left to flow away in the streams or to fill the ponds.

In a report of the Kansas Board of Agriculture the following table is given, containing the results of investigations by M. E. Risler, a Swiss observer, upon the daily absorption of water by different kinds of crops:

CROP.	INCHES OF WATER.	
	Min.	Max.
Lucern grass	0.134	0.267
Meadow grass	0.122	0.287
Oats	0.140	0.198
Corn	0.110	1.570
Clover	0.140	.....
Wheat	0.106	0.110
Rye	0.091	.....
Potatoes	0.038	0.055
Oak trees	0.030	0.038
Fir trees	0.020	0.043

This table has been found to agree quite closely with experiments made in France and elsewhere, and the conclusion is reached that from seed-time to harvest the cereals will take up fifteen inches of water, and grass may absorb much more. This has been found to be about the necessary amount of water for successful irrigation. And in this we may also see the economic value of forests in conserving moisture. They shield the ground, preventing rapid evaporation by wind or sun, and they do not absorb and transpire as much water as the field crops.

The Wisconsin Experiment Station made some interesting experiments to determine the amount of water required to produce a pound of dry matter of the several crops. From these experiments it was found that to produce a pound of the dry matter of corn required the use of 301.49 pounds of water; of barley, 401.74 pounds, and of oats, 501.47 pounds. These figures illustrate the tremendous drafts made upon our annual water supply in the production of the staple crops of a single season. There is no way to grow crops but by the liberal use of water, either by natural or artificial irrigation. In the olden time we had more water on hand because we did not use such prodigious amounts in crop production. And it may be assumed that as we go on increasing the annual output of our soil, we must make wise provision to conserve our water supply.

To this end there should be a vast increase in the area of tile-drained lands. Wherever there is a patch of cold, heavy, wet soil, put in the tile ditches, and put them in plentifully. The best way to conserve moisture is to put it under ground, and cover it with a dry mulch, so that the sun will not turn it into vapor and the winds blow it away. Don't allow the moisture which is needed for plant growth to spread over the surface, to stagnate or evaporate in the sunshine. Make your soil porous by judicious cultivation, and by occasional subsoiling. The deeper it is stirred below the ordinary depth of plowing and cultivating the better. When it is friable to the depth of eighteen or twenty inches it will absorb and retain a vast amount of water, which percolates into the subsoil and underlying strata, forming a reserve of moisture whence plants draw their supply during the rainless periods. Remember that a sponge will take up and hold a great deal more moisture than a bone or than a mass of impervious clay.

And another way to conserve moisture is to plant trees, and plant them thickly, so as to establish forest conditions. The value of shelter belts, and even of scattering hedge rows, has been abundantly proven in the experience of the past season. If we had judiciously planted two or three million acres of dense groves twenty to thirty years ago, on comparatively worthless lands, the investment would now pay very large annual dividends.

If I had a farm I would reclaim by drainage every rod of wet land that could possibly be ditched, and would balance the account with nature by covering steep side hills and barren knolls with dense groves, to prevent washing away the soil, and to assist nature in storing up the surplus water. The only surface water I would tolerate on the place would be in deep ponds or reservoirs, formed by damming up streams, or by excavation for the reception of the surplus flowage of tile-drains. These ponds could be utilized for fish culture, and for the annual ice crop, and they would also serve a purpose as feeders of stock wells in dry seasons. But I would not construct ponds with the notion that they would increase evaporation and rainfall.

Don't worry over the problem of increasing the humidity of the air, or making it rain. Leave the matter to Providence working through natural law. The proper work for man is to co-operate with nature, by preparing the soil for the produc-

tion of crops. To do this it is necessary to facilitate the passage of rainfall into the soil, where it will do the most good, removing it from the surface where it is harmful to crops or is soon dissipated and blown away.

So I conclude by saying: Drain your lands and do it thoroughly. Ditch and drain as if you were certain the next quarter of a century would bring a vast surplus of moisture. Put your soil in the best possible condition to withstand excessive rains and floods, and it will then be in excellent shape to withstand the most severe drouths.

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* Paper read before the State Agricultural Society January 10, 1895, by J. R. Sage.

SANITARY CLIMATOLOGY.

The interest manifested by every class of people in the subject of climate and its influence on health and disease has determined the Honorable the Secretary of Agriculture, through the medium of the Weather Bureau, to undertake the systematic investigation of the subject.

It is hoped to make the proposed investigation of interest and value to all, but especially to the medical and sanitary professions, and to the large number of persons who seek, by visitation of health resorts and change of climate, either to restore health or prolong lives incurably affected or to ward off threatened disease.

The study of the climates of the country in connection with the indigenous diseases should be of material service to every community in showing to what degree local climatic peculiarities may favor or combat the development of the different diseases, and by suggesting, in many instances, supplementary sanitary precautions; also by indicating to what parts of the country invalids and health seekers may be sent to find climatic surroundings best adapted to the alleviation or cure of their particular cases.

The hearty cooperation of the various boards of health, public sanitary authorities, sanitary associations and societies, and of physicians who may feel an interest in the work, is asked to achieve and perfect the aims of this investigation.

No compensation can be offered for this cooperation other than to send, free of cost, the publications of the Bureau bearing upon climatology and its relation to health and disease to all those who assist in the work.

Cooperation will consist in sending to this office reports of vital statistics from the various localities. That these reports may be of value, it is evident to all that they should be accurate and complete, and be rendered promptly and regularly. Blank forms of reports have been prepared so as to occasion as little trouble and labor as possible on the part of the reporter, and will be furnished by the Bureau on application.

At the very beginning of the investigation it is not possible to outline precisely the channels through which the results obtained will be made public, but it is hoped soon to publish a periodical devoted to climatology and its relation to health and disease. The publication will probably resemble in size and general appearance the present Monthly Weather Review, the subject matter being, of course, different.

More detailed information will be furnished on application.

MARK W. HARRINGTON,
Chief of Bureau.

THE INFLUENCE OF THE MOON.

In "Popular Astronomy" by M. Camille Flammarion, the eminent French astronomer and scientist, a chapter is devoted to an interesting discussion of the influences of the moon on the weather.

He says that "the luminous or calorific action of our satellite is so feeble that it by no means explains the popular prejudices." In directing the most powerful lenses and reflectors toward the moon and then placing in their focus very sensitive thermometers, nothing has has ever been discovered that could lead to the conclusion that heat or cold is produced directly or through reflection. According to the most delicate experiments of famous scientists, the heat of the lunar rays which reach the surface of the earth is scarcely twelve millionths of a degree. This almost imperceptible heat increases slightly as we rise from the earth's surface. As to its luminosity, photometric measures show that the light of the full moon is approximately 300,000 times less than that of the sun, and according to Professor Young, a sky completely covered with full moons would give only one-eighth of the light which we get from the sun. Thus it seems improbable that the heat and light which are derived from our satellite have the power to influence our meteorological phenomena. On the subject of atmospheric tides M. Flammarion says in brief that "the sun and moon exercise their actions on the atmospheric air just the same as on the sea and there result in the atmosphere, true tides. But how can we ascertain their existence? We are not placed in a position to see the external surface of our atmosphere, as we see the surface of the sea. Situated at the bottom of the atmosphere, we cannot perceive the existence of atmospheric tides, as we could not perceive the tides of the ocean if we were placed at the bottom of the sea. The atmospheric tides can only be rendered perceptible by the periodical variations of the pressure of the atmosphere at the place where we are—that is to say, by the alternate increase and decrease in the height of the barometric column, which serves to measure this pressure. Calculation shows that this would only be some hundredths of an inch of difference in the barometer. The daily observations show that the height of the barometric column experiences at one and the same place accidental variations, which may amount to 1¼, 2, and even 2½ inches, and that it frequently varies several hundredths of an inch without any great atmospheric disturbances. If the tides produced in the atmosphere by the action of the moon take part in these variations, it must be acknowledged that this part is very feeble, and that we are not warranted in seeing therein one of the principal causes of those changes of weather which we should have so much interest in being able to predict."

It has been found that at Paris the maximum of rainy days occurs between the first quarter and the full moon, and the minimum between the last quarter and the new moon; this has also been found true at Stuttgart, but at Poitiers, not 300 miles from Paris, just the opposite was found to be true. It will be seen, then, with our present knowledge of the subject, very little can be based on the phases of the moon and their influences upon our weather.

M. Flammarion says regarding the faith of farmers and sailors in the predictions made during the various phases of

the moon, "they only consider them within a day or two before or after the change; noticing one fact in agreement, and neglecting ten which are not so. The prediction of the weather for a long time ahead cannot, then, inspire any confidence in so far as it is based on the motions of the moon. This prediction of the weather cannot, besides, be better based on other grounds. At present it is absolutely futile to venture conjectures on fine or bad weather for a year, a month, or even a week in advance."

A common saying among sailors is that "the moon eats up the clouds." They think that the clouds melt away as soon as the moonlight strikes them. This is also noticeable in the daytime; light clouds diminish and disappear in a few moments in consequence of a change in their height or the temperature of the surrounding air. In such a case the moon would have nothing to do with it, and would only enable us to see the fact which is not noticed on dark nights.

In closing the chapter on this subject the eminent physicist says: "Without being able to deny in an absolute manner the reality of some of the influences which have not been proved, observation and discussion do not warrant us in sharing the popular beliefs. Scientific men are sometimes accused of not yielding to evidence; but here the evidence is far from being real. Without denying anything, science can only admit what is *ascertained*."

That there is an extensive field for research in this branch of meteorology, no one doubts, but it seems hardly probable that it can ever be accurately determined just how much, if any, the moon influences the weather changes and climatic conditions of the earth. Yet, science is ready to be convinced if any one will assert a single conclusive experiment.—*Fred. H. Tower, in New England Weather Bulletin.*

THE SEASON FOR COLDS.

Why are not people as careful of their lives as is a florist of his plants? Flowers are kept—by those who know how to keep them best—in a greenhouse where the air is carefully regulated to a certain temperature. Our houses, on the other hand, are sometimes too cold, but much more frequently too hot. In a New York apartment, for instance, steam heat commonly raises the temperature of the rooms to 80 or 85 degrees Fahrenheit. We endure the heat till it becomes unbearable, and then there is no remedy but the sudden chill of an opened window. This is not fair treatment of the human organism, which is as sensitive as most of the florist's carefully preserved plants.

Most doctors agree that pure, cold air is not in itself the main cause of the throat and lung troubles that prevail during the winter season, and that sudden changes of temperature and poor ventilation of buildings are much more dangerous to health than sharp outdoor airs. To avoid the visitations of that pertinacious malady which we commonly call "a cold" one good rule is to keep your house at an even, moderate temperature, not above 70 degrees. Another is to follow out common sense principles in the matter of winter clothing. A third is to maintain the general physical condition of the body by observing the elementary rules of health, and especially by taking regular, sufficient exercise.—*Munsey's.*

GOVERNMENT CROP REPORT.

Estimates of the area, product and value by states and territories of the cereal crops, together with those of potatoes and tobacco, have been completed by the statistician of the agricultural department, and are as follows:

The corn crop of 1894 in rate of yield is one of the lowest on record. In the past thirteen years the yield per acre but one year, 1881, was lower, the yield for that year having been 18.6 against 19.4 for 1894. The severe drought and dry winds in the principal corn producing states reduced the area harvested for grain value to 62,578,000 from 75,000,000 acres planted. The product garnered was 1,212,780,000 bushels, having the estimated farm value of $554,719,000.

The wheat crop was above the average in yield per acre. The entire product for the country was 360,467,416 bushels, which was below the average for five years, 1890 to 1894 inclusive. The farm value of the crop is $226,902,025. The area, according to revised estimates, is 24,882,436 acres. In the revision of acres the principal changes are made on the spring wheat states. The rate yield is 13.2 bushels per acre. The average value per bushels 49.1 cents.

Estimates for oats area is 27,023,553 acres; product, 662,(86,928 bushels; value, $214,816,920; yield per acre, 24 5 bushels.

Rye: area, 1,944,780 acres; product, 26,727,615 bushels; value, $13,394,000.

Barley: area, 3,160,602 acres; product, 61,400,465 bushels; value, $27,134,127.

Buckwheat: 789,232 acres; product, 12,668,200 bushels; value, $7,040,257.

Potatoes: 7,737,973 acres; product, 170,787,338 bushels; value, $91,526,787.

Tobacco: 553,103 acres, product, 406,677,385 pounds; value, $27,760,739.

SUMMARY OF WEATHER CONDITIONS FOR 1894.

Barometer—Mean pressure for the year, 30.036 inches; highest observed, 30.96 inches, on December 27, at Sioux City; lowest observed, 29 20 inches, on February 9, at Keokuk; range for the State, 1.76 inches; average monthly range, 1.10 inches.

Temperature—Mean temperature for the year, 49.7°; highest temperature reported, 109°, on July 26 and 27, at Spirit Lake; lowest, -37°, on January 25, at Ames; range for the State, 146°; average monthly range, 78.8°.

Precipitation—Average for the State, 21.95 inches; the greatest monthly rainfall reported was 7.43 inches, at Keosauqua, in September; the least was trace at numerous places in February, July, August and November; the greatest amount reported for any 24 consecutive hours was 2 77 inches, at Atlantic, on the 1st of October.

Wind—Prevailing direction, northwest; maximum velocity reported was 70 miles an hour, from the south, at Sioux City on June 20.

There were 184 clear days during the year, 109 partly cloudy, 72 cloudy, and 66 days on which .01 inch or more of precipitation fell.

TEMPERATURE AND PRECIPITATION FOR 1894.

The following table gives the monthly and annual mean temperatures and average precipitation for the State for the year 1894:

MONTH	Mean Temperature—Degrees	Precipitation—Inches
January	19.3	1.09
February	19.7	0.89
March	41.0	2.08
April	51.7	3.07
May	61.1	1.87
June	73.2	2.67
July	76.4	0.63
August	74.6	1.58
September	65.1	3.57
October	51.7	2.67
November	32.7	0.92
December	30.1	0.95
Means	49.7	21.95

These figures show that 1894 was one of the warmest and dryest years known in Iowa since weather observations have been recorded. The average precipitation for the State was only 21.96 inches, which is about 13.00 inches below the normal amount. The daily mean temperature was about 3.2° above the normal for this State.

FEBRUARY'S PAST WEATHER RECORD.

DES MOINES—SIXTEEN YEARS' RECORD.

Temperature—Mean or normal, 23°. The warmest February was that of 1882, with an average of 36°. The coldest February was that of 1885, with an average of 14°. The highest temperature during any February was 68°, on the 24th, 1880. The lowest temperature during any February was 23° below zero, on the 4th, 1893.

Precipitation—Average for the month, 1.32 inches. Average number of days with .01 of an inch or more, 8. The greatest monthly precipitation was 2.68 inches, in 1881. The least monthly precipitation was 0.17 inches, in 1880. The greatest amount of precipitation recorded in any 24 consecutive hours was 1.14 inches, on the 18th and 19th, 1888.

Clouds and Weather—Average number of clear days, 9. Average number of partly cloudy days, 11. Average number of cloudy days, 8.

Wind—The prevailing winds have been from the northwest. The highest velocity of the wind during any February was 36 miles, on the 4th, 1889, and on the 3d, 1891, from the north.

DAVENPORT—TWENTY-THREE YEARS' RECORD.

Temperature—Mean or normal, 25°. The warmest February was that of 1882, with an average of 39°. The coldest February was that of 1875, with an average of 10°. The highest temperature during any February was 67°, on the 12th, 1882. The lowest temperature during any February was 21° below zero, on the 9th, 1888.

Precipitation—Average for the month, 1.67 inches. Average number of days with .01 of an inch or more, 9. The greatest monthly precipitation was 4.85 inches, in 1887. The least monthly precipitation was 0.07 inches, in 1877. The greatest amount of precipitation recorded in any 24 consecutive hours was 29.1 inches, on the 15th and 16th, 1883. The greatest amount of snowfall recorded in 24 consecutive hours (record extending to winter of 1884-5 only), was 9 inches, on the 8th and 9th, 1885.

Clouds and Weather—Average number of clear days, 8. Average number of partly cloudy days, 10. Average number of cloudy days, 10.

Wind—The prevailing winds have been from the northwest. The highest velocity of the wind during any February was 46 miles, on the 28th, 1880.

KEOKUK—TWENTY-THREE YEARS' RECORD.

Temperature—Mean or normal, 29°. The warmest month was that of 1882, with an average of 40°. The coldest month was that of 1885, with an average of 17°: The highest temperature was 70°, on the 24th, 1891. The lowest temperature was 18° below zero, on the 4th, 1886.

Precipitation—Average for the month, 1.80 inches. Average number of days with .01 of an inch or more, 8. The greatest monthly precipitation was 6.13 inches in 1883. The least monthly precipitation was 0.15 inches, in 1887. The greatest amount of precipitation recorded in any 24 consecutive hours was 3.66 inches, on the 15th and 16th, 1883. The greatest amount of snowfall recorded in any 24 consecutive hours (record extending to winter of 1884-5 only), was 8.0 inches, on the 17th, 1893.

Clouds and Weather—Average number of clear days, 8. Average number of partly cloudy days, 10. Average number of cloudy days, 10.

Wind—The prevailing winds have been from the northwest. The highest velocity of the wind was 40 miles, from the north, on the 28th, 1876.

SIOUX CITY—FIVE YEARS' RECORD.

Temperature—Mean or normal, 20°. The warmest February was that of 1892, with an average of 23°. The coldest February was that of 1891, with an average of 18°. The highest temperature during any February was 62°, on the 15th, 1890. The lowest temperature during any February was 21° below zero, on the 1st, 1893.

Precipitation—Average for the month, .72 inches. Average number of days with .01 of an inch or more, 7. The greatest monthly precipation was 1.26 inches, in 1891. The least monthly precipitation was .19 inches, in 1894. The greatest amount of precipitation recorded in any twenty-four consecutive hours was .66 inches, on the 8th and 9th, 1891. The greatest amount of snowfall recorded in any twenty-four consecutive hours (record extending to winter of 1889-90 only) was 7.2 inches, on the 8th and 9th, 1891.

Clouds and Weather—Average number of clear days, 10. Average number of partly cloudy days, 8. Average number of cloudy days, 10.

Wind—The prevailing winds have been from the northwest. The highest velocity of the wind during any February was 44 miles, on the 24th, 1891, and on the 9th, 1894.

DECEMBER WEATHER RECORD.

The month of December was unusually warm, dry and pleasant. The daily mean temperature was 30.1 degrees, which is 7.5 degrees above the normal. The only exceptionally severe weather was during the prevalence of the cold wave on the 26th to 28th. The highest barometer at the central station was 30.83, on the 27th.

The average precipitation for the State was 0.95 of an inch, which is 0.70 of an inch below the normal amount for December. The amount of snowfall was unusually light.

The following table gives, as a basis of comparison the mean temperature and total precipitation for the month of December, at the stations named, for the years from 1872 to 1894 inclusive.

YEARS	MEAN TEMPERATURE, DEGREES.					PRECIPITATION, INCHES.				
	Des Moines.	Davenport.	Keokuk.	Omaha.	Sioux City.	Des Moines.	Davenport.	Keokuk.	Omaha.	Sioux City.
1872	....	18	18	18	....	.....	0.61	0.50	0.12	.....
1873	....	30	32	25	....	.....	3.84	8.56	0.93	.....
1874	....	28	31	28	....	.....	0.50	1.26	0 54	.....
1875	....	34	36	34	....	.....	3.08	3.93	1.00	.....
1876	....	15	19	19	....	.....	0.36	0.23	0.16	.....
1877	....	42	45	39	....	.....	2.32	2.90	2.14	.....
1878	20	20	22	22	....	1.15	0.97	1.95	0.27	.....
1879	21	24	27	17	....	1.39	1.02	1.45	1.75	.....
1880	20	22	25	18	....	0.86	1.15	0.67	0.28	.....
1881	35	28	38	36	....	0.85	1.71	1.70	1.56	.....
1882	24	31	28	25	....	2.50	1.78	1.75	0.92	.....
1883	27	28	32	29	....	1.08	0.99	1.20	0.73	.....
1884	18	25	24	17	....	1.93	3.68	3.91	0.72	.....
1885	28	26	28	29	....	1.96	1.95	1.96	1.17	.....
1886	19	18	22	18	....	0.81	0.53	1.03	1.46	.....
1887	23	24	28	24	....	1.42	3.26	2.93	1.11	.....
1888	29	30	34	30	....	2.44	2.59	1.61	0.96	.....
1889	40	40	43	39	35	0.57	1.60	1.08	0.50	1.14
1890	32	30	34	35	32	0.11	0.62	0 03	0.08	0.10
1891	35	35	38	35	31	1.54	1.64	1.33	2.07	2.48
1892	20	20	26	22	21	1.95	2.73	1.50	1.79	0.20
1893	23	24	29	27	20	1.30	1.67	0.90	1.13	1.57
1894	33	32	35	33	30	1.15	0.61	1 06	0.94	1.30
Means	28	28	30	26	28	1.35	1.77	2.10	0.97	1.13

SUMMARY OF WEATHER CONDITIONS.

Barometer—Mean pressure for the month, 30.16 inches; highest observed, 30.96, at Sioux City on the 27th; lowest observed, 29.35, at Sioux City on the 15th; range for the state, 1.61 inches.

Temperature—Monthly mean, as deduced from 77 voluntary observers' reports, was 30.1°; highest monthly mean, 35.0°, at Keokuk; lowest monthly mean, 25.3°, at Osage; the highest temperature reported was 73°, at Knoxville on the 7th; the lowest temperature reported was 17° below zero, at Rock Rapids and Spirit Lake on the 27th; the average daily maximum was 38.5°; the average daily minimum was 21.8°; the average monthly maximum was 59°; the average monthly minimum was 7.5° below zero; the greatest monthly range was 78°, at Knoxville; the least monthly range was 50°, at Hopkinton; average monthly range, 66.5°.

Precipitation—Average for the State, as determined from the reports of 81 voluntary observers, 0.95 of an inch; the largest amount reported was 1.75 inches, at Decorah and Sac City; the least amount reported was 0.25, at Maxon; the greatest daily rainfall reported was 1.40 inches, at Cedar Falls on the 15th; average number of days on which .01 inch or more of precipitation was reported, 3.

Wind—Prevailing direction, northwest; highest velocity reported, 48 miles per hour, from the northwest, on the 8th at Sioux City.

Miscellaneous—There were 15 clear days, 6 partly cloudy and 10 cloudy.

Auroras—Clinton, 3d.

Solar Halo—Cresco, 20th; Greenfield, 14th; Monticello, 18th.

Lunar Halo—Ft. Madison, 4th and 14th; Ovid, 15th.

Fog—Forest City, 1st, 7th and 8th; Independence, 1st; Maxon, 1st; Ogden, 22d; Osceola, 10th and 22d; Spirit Lake, 7th, 9th and 10th.

Total snowfall ranged from trace to 3½ inches.

ATMOSPHERIC PRESSURE.

STATIONS	Mean reduced barometer.	EXTREMES. Highest reduced barometer.	Date.	Lowest reduced barometer.	Date.
Cedar Rapids	30.16	30.74	27	29.57	7
Clarinda	30.19	30.90	27	29.46	7
Cresco	.....	30.76	27	29.48	15
Davenport	30.12	30.63	27	29.59	16
Des Moines	30 16	30.83	27	29.44	7
Keokuk	30.18	30.69	27	29.63	16
Omaha (Neb.)	30.18	30 94	27	29.40	15
Sioux City	30.14	30.96	27	29.35	15
Means	30.16	30.81	..	29.49	..

WIND MOVEMENT.

STATIONS	Number of miles.	Maximum velocity.	Direction.	Date.
Davenport	7,514	41	SW	16
Des Moines	6,383	33	W	8
Keokuk	6,588	36	W	16
La Crosse (Wis.)	6,294	26	W	16
Omaha (Neb.)	5,734	26	S	20
Sioux City	7,570	48	NW	8

OBSERVERS' NOTES.

Amana—*C. Schadt.* The weather was very fine and mild during the month, with frequent hoar frost in the mornings, and several fine rains, which brought some water to the river, which had been exceptionally low. Wild geese were on the open waters till Christmas, when cold weather set in and ice formed in a few days became about six inches thick.

Atlantic—*J. W. Love.* Has been the finest and warmest December for years.

Carroll—*Moses Simon.* Farmers plowed nearly the whole month.

Cedar Rapids—*H. D. Olds.* There have been no serious storms during the month. A high barometer has prevailed during the latter half, with pleasant weather without snow. The mean temperature has been about 5° above the normal for December for the past ten years. Ice has again formed on the river, which was open during the earlier part of the month, but the streams and wells are very low, and in many cases it is difficult to supply stock.

College Springs—*A. A. Berry.* Another very dry month. Water very scarce. Very open winter. Stock looking well.

Elkader—*Chas. Reinecke.* No snowfall during December except slight traces.

Fort Madison—*Miss L. A. McCready.* Christmas day was so warm and pleasant that two parties went on river excursions.

Grand Meadow—*F. L. Williams.* The month has been unusually dry and warm. The best rain for two months fell on the night of the 15th and all soaked into the ground.

Iowa City—*Albert L. Arner.* Comparative temperature and rainfall table:

YEAR.	MEAN TEMP.	RAINFALL.
1892	19.5 degrees.	2.84 inches.
1893	26.0 degrees.	1.52 inches.
1894	31.4 degrees.	.98 inches.

Normal rainfall for 23 years, 1.74 inches.
Normal temperature for 18 years, 27.6.

Monticello—*H. D. Smith.* Plowing till the 24th. Wild geese flew south on the 22d.

Ottumwa—*L. T. Baker.* Des Moines river closed on the 27th.

Ovid—*N. C. Miller.* Parhelia on the 2d, 3d, 27th and 28th. On the 24th there was no frost in the ground and no ice. Farmers plowing. The usual fall rains have missed us and there is less moisture in the ground than for thirty years. The subsoil is about as dry as it can be.

Bonaparte—*Hon. B. R. Vale.* The following table shows the monthly and annual precipitation at this station for the past three years:

YEARS	PRECIPITATION—INCHES												
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annu'l
1892.....	1.13	1.66	3.95	7.00	6.	3.93	4.79	2.18	3.40	0.76	2.71	1.89	39 93
1893	0.60	1.42	2.79	5.13	4.	4.27	2.40	2.02	5.13	1.45	1.61	1.17	32.30
1894.....	1.40	1.50	2 51	2.83	2.	1 82	0.19	1.60	7.32	1.71	1.80	0.52	25.81

Fort Dodge—*R. W. Blain.*—The year ending December 31, 1894, has been the driest in sixteen years, the total precipitation being 22 inches of snow (unmelted), and 14.89 inches of rain. During the crop season, April 1 to Oct. 1, we had 1½ inches of snow, and 9½ inches of rain. There were 244 clear days, 23 partly clear, and 98 cloudy. The lowest temperature occurred January 24, when it was 23° below zero. The temperature dropped below zero twenty-three times, and remained below all day for three days. The highest temperature occurred July 26, when it was 104° above, with high wind from the south. The last killing frost was on May 20; first killing frost in the autumn, September 11.

Clinton—*Dr. Luke Roberts.* December, 1894, was remarkable for its uniformity of temperature, its abundance of sunshine, and its small amount of precipitation. The per cent of clouliness was less than for any December for the past 16 years, and so, also, was the number of storm days. The rainfall was less than any other December during the six. teen years, being only .63 of an inch. Only one other December furnished less than one inch of water, viz: 1880—.78 of an inch. A few lonely flakes on the evening of the 26th is all the snow the month could furnish.

While December, 1894, was pleasant, comfortable, and lacking in the wintry rigors which characterized some of its predecessors, while it proved agreeable to our physical being, and furnished no hindrance to the avenues of trade, and impressed the masses of the people with the idea that there never was the like of it in their remembrance, let us turn to the record and see if we cannot find a precedent.

The maximum temperature for December, 1894, was 55°; the minimum temperature 4° below zero; the mean temperature 30.2°; the mean for the warmest day 50.2°, and the mean for the coldest day 5.3°. In 1891 the maximum was 54°; the minimum zero; mean, 32.7°; the mean for the warmest day 50.3°, and the coldest day 11°.

December, 1881, the record breaker, gave the following figures. Maximum, 65°; minimum, 90.5°; mean, 37.5°; warmest day, 53.5°; and the coldest day 13°. December, 1881, 1888 and 1891, did not give temperature below zero.

The total movement of the wind was 5,140 miles, being about normal. The maximum velocity was 27 miles—also normal. The prevailing direction was from the southwest. The 16th was a very windy day, but warm. The 27th was also a windy day, and cold and dusty. This was the coldest day of the month, but the minimum temperature was reached the next morning, being 4° below zero. This was the only time during the month that the temperature touched zero, that point being reached about one o'clock a. m. The 31st was a lovely day, and as the month passed into history and closed the meteorological records of 1894, she left a parting smile, and bid us a happy and prosperous new year.

Williams—*M. L. Fuller.* The past seven years have given December the following averages: Temperature, 23°; precipitation, 1.34 inches. December was therefore about normal in meteorological conditions. But two light snow storms during the month; snow soon melted and was practically no protection to winter grains and grass. No damage yet by drouth.

BELATED REPORTS.

Hawkeye (September, 1894).—Total rainfall, 1.95 inches. Rain fell on seven days.

Mooar (November, 1894).—Mean temperature, 39.2°; maximum temperature, 72°, on the 15th; minimum temperature, 8°, on the 19th. Total rainfall, 1.70 inches. Rain fell on three days. Trace of snow during the month.

Mt. Pleasant (November, 1894).—Mean temperature, 35.8°; maximum temperature, 57°, on the 26th; minimum temperature, 8°, on the 19th. Total rainfall, 1.62 inches. Rain fell on four days.

Clinton (November, 1894).—Mean temperature, 33.2°; maximum temperature, 65°, on the 15th; minimum temperature, 8°, on the 19th. Total rainfall, 1.75 inches. Rain fell on eight days

Toledo (November, 1894).—Mean temperature 32.4°; maximum temperature, 58°, on the 15th; minimum temperature, 1°, on the 19th. Total rainfall, .97 of an inch. Rain fell on two days.

Maxon (November, 1894).—Mean temperature, 32.5°; maximum temperature, 65°, on the 15th; minimum temperature, 4°, on the 28th. Total rainfall, 2.03 inches. Rain fell on three days.

METEOROLOGICAL DATA FOR DECEMBER, 1894.

STATIONS.	TEMPERATURE OF THE AIR (IN DEGREES FAHRENHEIT).								PRECIPITATION, IN INCHES.				Prevailing direction of wind.	No. of cloudless days.	No. partly cloudy days.	No. of cloudy days.	No. of rainy days (.01 inch or more).
	Monthly mean.	EXTREMES.						Monthly range.	Monthly.	Greatest daily.	Total snowfall.	Depth of unmelted snow at end of month.					
		Mean maximum.	Mean minimum.	Maximum.	Date.	Minimum.	Date.										
Afton	30.0	36.1	22.8	60	7	-9	28	69	1.10	.85	2.5	.....	SW	10	11	10	
Algona	28.4	.....	.....	55	20	-13	27	68	.97	.90	1.5	T	SW	12	10	9	
Alta	27.4	35.9	18.9	54	7	-14	27	68	.98	.82	.7	0	NW	16	8	7	
Amana	30 3	37.1	23.5	58	7	-3	28	61	1.34	.64	1.0	0	SW	15	8	8	
Atlantic	29.5	39.6	19.4	65	7	-6	27	71	.97	.97	T	0	NW	19	3	9	
Atlantic (near)	30.8	38.7	23.0	60	7	-9	27	69	.70	.70	T	0	NW	13	6	12	
Ames	29.0	38 8	19.3	61	7	-14	28	75	.64	.60	.4	T	S	10	10	11	
Ames (Hielman)	.....	.....	.....	.....	.....	.....	.....	.....	.86	.76	1.0	0	NW	.....	.....	.....	
Audubon	30.3	38.7	21.9	60	7	-10	27	70	.75	.75	0	0	NW	7	11	13	
Belle Plaine	28.9	35.8	22.0	59	7	-3	28	62	.80	.80	3.0	0	NW, S	7	9	15	
Bonaparte	33.2	41.6	24.9	61	7	-2	28	63	.52	.30	.....	.....	.....	.....	.....	.....	
Carroll	29 6	38.4	20.8	60	7	-13	27	73	.96	.89	T	0	.....	14	9	8	
Cedar Falls	28.8	37.0	20.5	57	7	-6	28	63	1.40	1.40	T	.....	SW	17	5	9	
Cedar Rapids	32.6	38.8	26.5	61	7	-1	28	62	1.39	.67	.4	0	SW	19	3	9	
Charles City	29.1	37.5	20.7	56	7	8	27	64	1.49	1.04	7.5	0	NW	.....	.....	.....	
Clarinda	30.6	38.9	22.4	62	7	-7	27	69	.99	.64	1.5	0	NW	20	3	8	
Clinton	31.2	39.0	23 4	55	20	-4	28	59	.63	.37	.....	.....	SW	13	9	9	
College Springs	31.2	40.4	22.0	63	6	-7	28	70	.96	.56	1.5	.....	NW	16	10	5	
Corning	32.9	42.7	23.1	65	7	-6	27	71	84	.82	.2	.....	NW	18	5	8	
Cresco	26 4	33.0	19.9	50	7	-7	27	57	1.07	.73	3.0	0	NW	13	6	12	
Davenport	32.0	38.7	26.3	56	20	-2	28	58	.61	.21	.....	.....	SW	11	5	15	
Decorah	28.7	35 4	22.0	56	7	-6	27	62	1.75	1.50	2.0	.....	.....	14	7	10	
Delaware	27 6	.....	.....	52	7	-3	27	55	1.08	.82	.5	.....	NW	13	7	11	
Des Moines	32.6	39 9	25.4	65	7	-8	27	73	1.15	59	1.9	0	SW	15	4	12	
Dubuque	32 3	41.0	24.6	56	7	-5	28	61	.35	.26	T	0	S	17	0	14	
Elkader	29.0	37.3	20 6	54	7	-6	28	60	.91	.41	T	0	NW	15	6	10	
Emmetsburg	27.8	37.4	18.3	53	19	-14	27	67	1.20	.97	2.5	0	SW	17	2	2	
Fairfield	31.6	39.0	23 3	61	7	1	27	60	.64	.41	.....	.....	.....	10	9	7	
Forest City	26.1	35.7	16.4	53	15	-13	27	66	73	.73	.5	.....	SW	14	5	12	
Ft. Madison	34.5	.....	.....	60	21	3	28	57	1.12	.50	.....	.....	SW	9	11	11	
Galva	29.5	39.3	19.7	58	20	-12	27	70	93	.70	.....	.....	.....	.....	.....	.....	
Glenwood	31.1	41.4	20 8	70	7	-10	27	80	.86	.75	T	.....	NW	21	5	5	
Greenfield	31.3	41.1	21.5	63	7	-10	27	73	.88	.67	1.1	.....	NW	12	5	14	
Grand Meadow	28.6	.....	.....	54	7	-6	27	60	1.18	.91	2.5	.....	SW	11	5	15	
Grundy Center	28 7	36.5	20.8	60	7	-5	27	65	1.02	.95	.7	0	NW	14	4	13	
Hampton	26.5	35.3	17.8	58	7	-10	27	68	1.10	.94	1.5	0	NW	12	14	5	
Hawkeye	.....	.....	.....	.....	.....	.....	.....	.....	1.41	.86	.....	.....	.....	.....	.....	.....	
Hopeville	31 3	39.7	22.9	64	7	-8	27	72	.86	.50	.....	.....	NW	4	20	7	
Hopkinton	29.5	.....	.....	52	7	2	27	50	1.10	.90	2.0	0	NW	15	10	6	
Humboldt	.....	.....	.....	.....	.....	.....	.....	.....	1.06	.90	.....	.....	S	17	7	7	
Independence	29.3	38 3	20.3	56	7	-6	28	62	.95	.80	1.5	.....	NW	15	11	5	
Indianola	31.8	40.8	22.9	66	7	-9	27	75	.90	.28	.2	.....	NW	18	1	12	
Iowa City	31.5	39.8	24.2	58	6	-3	28	61	.98	.52	.2	.....	NW	.....	.....	.....	
Iowa Falls	28.1	37.4	18.9	58	7	-11	27	69	.89	.73	4.0	0	.....	.....	.....	.....	
Keosauqua	34.8	43 1	26.4	63	7	0	28	63	.65	.33	T	0	.....	.....	.....	.....	
Keokuk	35.0	41.4	27.8	61	7	-2	28	63	1.06	.34	.....	.....	SW	15	7	9	
Knoxville	30.7	37.6	23 7	73	7	-5	27	78	.90	.65	.....	.....	SW	17	2	12	
Larrabee	27.8	37.5	18.0	54	19	-14	27	68	1.29	1.04	.5	.....	.....	16	6	9	
Le Claire	.....	.....	.....	.....	.....	.....	.....	.....	.40	.18	.....	.....	.....	.....	.....	.....	
Logan	31.1	40.2	21.0	60	20	-8	27	68	1.14	1.14	.....	.....	S	20	4	7	
Mason City	26 4	36.1	16.6	50	14	-11	27	61	1.06	.88	.....	.....	.....	13	0	18	
Maxon	31.3	.....	.....	64	7	-4	27	68	.25	.15	.....	.....	.....	9	18	4	
Mechanicsville	30.7	37.6	23.9	58	6	-3	28	56	.94	.55	.....	.....	S	14	4	13	
Mt. Pleasant	34.7	.....	.....	58	7	3	28	55	.64	.35	.2	.....	NW	16	4	11	
Monticello	28.9	34.6	22.6	56	7	-3	27	59	.97	.78	.....	.....	NW	16	5	10	
Mt. Vernon	30.0	.....	.....	61	7	-6	27	67	.....	.....	.....	.....	.....	.....	.....	.....	
Newton	31.2	39.5	22.8	62	7	-7	27	69	1 30	.69	1 6	0	NW	15	7	9	
Ogden	29.3	40.2	18.4	64	7	-13	27	77	.98	.86	1.4	.....	NW	19	0	12	
North McGregor	.....	.....	.....	.....	.....	.....	.....	.....	.80	.60	.....	.....	.....	.....	.....	.....	
Omaha, Neb	33.0	41.3	25.1	61	20	-8	27	69	.94	.47	.....	.....	NW	15	4	12	
Osage	26.3	.....	.....	.....	.....	.....	.....	.....	1.33	.99	3.5	.....	NW	10	5	16	
Osceola	30.2	36.9	23.4	62	7	-8	27	70	.98	.64	3.0	.....	NW	14	4	13	
Oskaloosa	31.7	40.1	23.3	65	7	-3	28	68	.62	.50	1.0	.....	SW	16	2	13	
Ottumwa	34 2	42.7	25.0	66	7	-2	28	68	.66	.38	.2	.....	W	16	6	9	
Ovid	32.3	41.0	23 3	62	7	-5	27	67	.73	.50	2.2	0	NW	17	4	10	
Panama	30 0	38.0	22.0	57	7	-9	27	66	1.24	1.03	2.1	0	NW	17	3	11	
Richland	31.2	.....	.....	.....	.....	.....	.....	.....	.78	.51	2.2	.....	.....	13	10	8	
Rockwell City	26.9	37.1	16.7	60	7	-14	27	74	1.31	1.10	.....	.....	.....	21	1	9	
Rock Rapids	27.6	36.4	18.7	54	15	-17	27	71	1.00	1.00	T	0	S	.....	.....	.....	
Sac City	27.5	34.5	20 4	57	7	-14	27	71	1.75	1.25	T	0	NW	17	3	11	
Seymour	33.6	42.3	24.9	65	7	-5	27	70	1.20	.70	.....	.....	S	19	3	9	
Sibley	26.6	36.6	16.5	50	7	-16	27	66	1.15	1.00	2.0	.....	NW	12	13	6	
Sioux City	30 0	38 4	21.7	56	7	-12	27	68	1.30	.71	.....	.....	NW	12	9	10	
Spirit Lake	28 4	38.9	17.9	53	8, 21	-17	27	70	.90	.50	T	.....	SE	13	5	13	
Toledo	29.0	34.8	23.8	56	7	-5	28	61	.88	.70	1.8	.....	NW	20	0	11	
Villisca	31.0	40 2	22.1	63	7	-6	27	69	.88	.75	.2	.....	NW	18	4	9	
Vinton	30.4	.....	.....	.....	.....	.....	.....	.....	.74	.64	1 0	.....	NW	17	4	10	
Waukee	32.8	42.1	23.6	56	20	-9	27	65	.89	.61	3.0	.....	N	.....	.....	.....	
Washington	31.4	40.1	22.8	61	7	-5	28	66	.72	.48	.....	.....	SW	.....	.....	.....	
Webster City	27.6	.....	.....	57	7	-12	27	69	.90	.80	.8	...	SE	18	3	10	
Wilton	30.9	39.9	21.0	57	7	-5	28	62	.70	.70	T	.....	W	16	1	14	
Williams	26.6	.....	.....	58	7	-13	27	71	1.18	1.00	2.1	.....	NW	17	2	12	
Winterset	30.2	38.5	22.0	65	7	-10	27	75	1.03	.50	2.0	...	NW	15	5	11	
Means	30.1	38.5	21.8	59	....	-7.5	....	66.5	0 95	....	....	....	NW	14.8	6.0	10.2	3.1

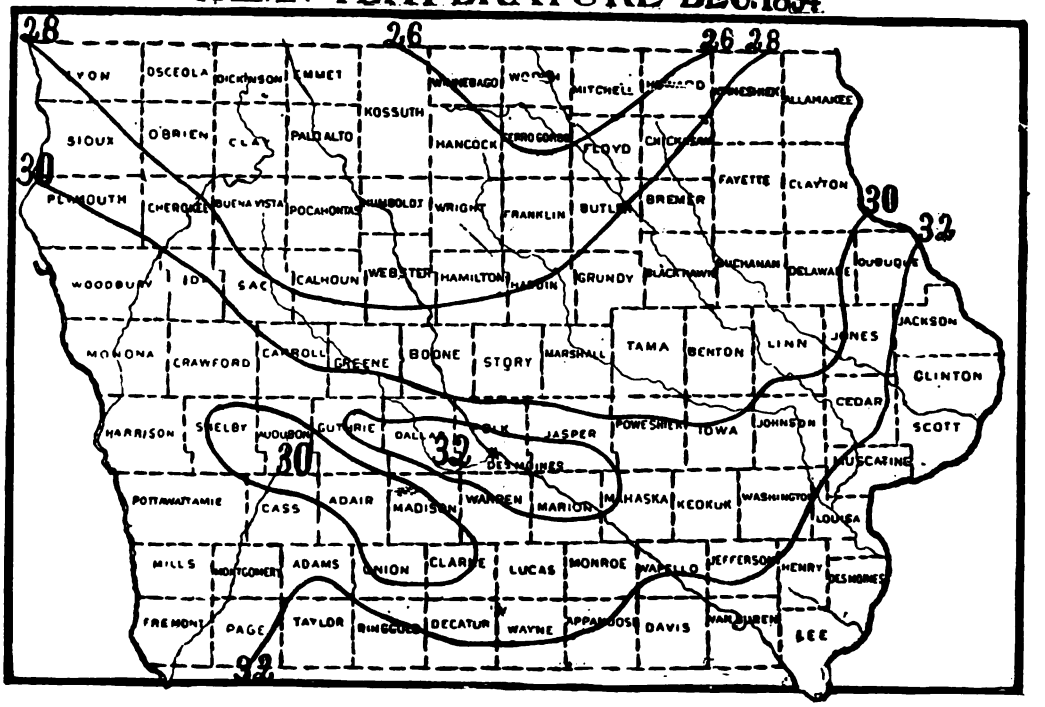
Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
Afton	34	17	23	30	35	40	54	33	30	32	32	31	30	36	40	32	34	36	38	43	48	43	30	28	22	17	-6	7	14	9	13	30.0
Algona	32	16	28	36	35	40	44	35	34	34	35	34	35	38	42	26	28	36	36	47	30	25	30	26	16	14	-6	15	15	6	14	28.4
Alta	32	5	38	34	33	38	44	24	30	30	33	30	32	38	41	24	31	36	39	48	33	27	29	24	17	15	-5	10	14	6	16	27.4
Amana	36	20	21	32	31	38	52	36	33	35	36	36	34	32	44	32	28	34	38	44	40	30	35	33	25	18	2	8	21	11	18	30.3
Ames	33	20	23	32	34	36	52	36	34	33	33	34	32	37	38	38	32	36	42	42	42	26	30	30	22	5	4	13	12	10	12	29.0
Atlantic	32	18	24	28	36	42	55	34	25	32	34	27	32	34	41	32	34	36	37	44	42	32	30	28	22	18	0	17	20	8	18	29.5
Atlantic (near)	31	30	28	34	37	42	54	40	22	32	34	32	34	40	44	36	33	36	38	42	44	30	32	30	22	18	2	12	18	10	19	30.8
Audubon	34	20	28	34	40	32	50	32	32	33	34	31	32	39	40	36	32	36	40	44	41	24	32	30	25	22	6	10	16	10	18	30.3
Belle Plaine	32	19	22	28	31	34	54	34	36	34	36	36	31	40	37	31	26	32	34	40	40	29	30	34	24	17	2	8	18	11	17	28.9
Bonaparte	34	26	24	34	38	38	54	42	32	33	34	36	36	40	45	42	32	34	42	46	38	33	34	38	30	21	11	10	25	18	21	33.2
Carroll	30	26	21	34	40	45	49	30	30	32	32	34	31	39	44	32	23	40	45	47	31	28	29	30	23	14	-6	9	21	8	11	29.5
Cedar Falls	30	30	23	34	36	36	50	33	34	34	35	35	39	34	40	33	24	29	35	40	42	37	28	29	30	22	14	12	0	11	14	28.8
Cedar Rapids	37	26	24	34	34	38	54	40	38	36	36	36	37	42	46	36	31	38	40	45	41	34	34	37	28	19	6	9	22	14	20	32.6
Charles City	28	16	20	29	33	32	51	32	34	34	35	40	32	35	42	26	26	32	39	44	38	28	29	24	21	19	1	28	18	11	18	29.1
Clarinda	32	22	26	33	36	41	52	39	32	31	34	32	33	38	42	35	34	34	38	46	41	30	34	32	24	18	-2	12	20	13	18	30 6
Clinton	36	26	22	29	36	36	50	39	32	35	36	34	37	41	46	38	28	32	35	42	42	32	33	34	26	20	10	6	21	13	18	31.1
College Springs	35	23	28	35	39	52	42	35	35	34	34	36	42	41	42	41	34	34	36	44	44	32	34	34	24	20	-2	8	19	16	21	31.2
Corning	34	23	26	35	39	45	58	36	30	32	36	33	38	42	45	36	36	38	42	48	49	31	32	35	24	22	7	13	22	8	15	32.9
Cresco	30	14	22	31	30	40	47	31	33	33	33	31	26	34	40	26	26	33	35	42	34	26	29	27	16	13	-4	11	14	8	12	26.4
Davenport	35	24	25	34	39	40	50	42	34	36	36	36	38	40	48	34	32	34	40	47	45	34	32	34	30	22	7	8	22	14	18	32.0
Decorah	33	16	20	32	34	35	49	44	32	36	34	34	30	36	40	26	29	32	36	41	43	28	30	29	18	13	-2	11	16	15	14	28.7
Delaware	32	30	19	28	30	35	48	31	33	34	34	33	30	39	41	30	26	30	32	41	38	30	31	31	21	19	-1	7	16	8	11	27.8
Des Moines	33	22	26	37	39	42	56	38	36	36	36	36	36	42	46	34	33	38	45	48	45	28	30	34	27	22	-2	12	20	14	20	32.5
Dubuque	34	26	25	34	38	37	50	42	35	36	36	36	39	40	46	39	34	34	39	44	45	35	32	35	26	20	12	10	20	14	20	32.3
Elkader	30	20	22	32	35	32	48	34	34	36	35	34	34	36	43	28	29	33	36	40	39	30	30	31	34	15	2	6	19	10	20	29.0
Emmetsburg	36	19	30	31	34	35	40	33	32	32	33	32	36	39	41	27	26	35	41	43	30	25	27	23	20	15	-4	13	16	2	18	27.8
Fairfield	34	26	21	26	34	37	52	40	32	34	35	36	34	42	46	36	28	33	38	44	44	34	35	36	26	18	11	12	20	14	19	31.6
Forest City	31	22	19	27	32	34	59	39	37	33	32	34	27	32	39	36	20	24	32	36	42	28	23	28	18	11	8	-4	14	10	5	26.1
Fort Madison	37	26	28	34	32	41	53	42	35	37	38	38	38	44	48	37	35	41	48	50	35	35	40	38	25	11	14	26	20	20	24	35.4
Galva	34	28	28	33	32	33	42	35	30	30	34	33	36	38	42	34	31	38	38	46	40	28	32	35	20	16	1	10	15	8	16	29.5
Glenwood	34	22	33	..	36	43	56	39	27	32	35	29	35	40	45	34	36	39	51	44	34	36	32	34	24	10	-5	13	13	12	16	31.1
Grand Meadow	31	24	24	35	28	42	48	32	34	34	34	33	30	40	43	28	28	32	36	46	36	29	31	28	18	14	-4	12	16	10	12	28.6
Greenfield	33	21	25	33	36	38	54	38	37	32	35	34	35	39	44	35	31	36	41	46	41	34	36	32	22	20	1	18	9	18	18	31.3
Grundy Center	24	18	27	36	37	44	44	33	34	34	35	30	33	43	38	25	33	34	42	47	35	28	31	24	18	11	-2	17	13	6	18	28.7
Hampton	28	15	24	33	34	37	45	30	34	31	30	33	32	38	40	26	26	34	40	43	32	24	28	26	20	15	-1	6	17	6	14	26.5
Hopeville	32	22	25	35	38	42	56	38	32	32	33	32	34	40	42	38	32	35	41	44	43	28	31	32	22	21	4	12	20	12	20	31.3
Hopkinton	34	18	20	31	35	38	48	35	34	34	35	35	34	37	42	32	29	32	36	42	42	31	31	32	22	17	4	9	16	10	16	29.4
Independence	28	22	22	30	35	33	48	42	32	32	34	33	33	35	41	32	29	32	38	40	42	32	28	30	22	17	12	6	17	12	16	29.8
Indianola	28	22	26	36	36	42	58	47	34	32	34	34	34	42	47	38	..	..	40	48	50	32	30	33	22	22	-2	14	18	15	12	31 8
Iowa City	34	22	22	32	36	41	48	36	32	34	35	36	36	38	44	38	30	32	40	46	..	36	32	36	28	21	14	8	21	16	20	31 5
Iowa Falls	26	18	22	31	32	37	49	35	34	32	34	34	32	38	40	34	27	34	39	44	38	24	28	27	20	16	2	7	16	8	15	28 1
Keokuk	36	24	26	37	42	42	54	45	32	34	36	37	40	44	49	38	33	37	44	50	50	32	34	39	32	23	8	10	26	19	22	35.0
Keosauqua	35	24	26	36	42	38	55	49	35	35	36	37	38	32	47	40	34	34	41	43	48	36	34	38	30	23	14	12	24	20	25	34.8
Knoxville	33	22	26	36	36	43	58	33	35	33	34	34	32	38	43	32	30	36	42	44	44	30	30	32	24	18	-2	8	19	10	19	30.7
La Crosse, Wis	30	19	24	36	38	48	57	36	36	34	34	36	40	42	32	28	37	38	44	39	34	31	32	30	16	3	8	18	12	18	20	30.2
Larrabee	30	18	30	32	34	38	40	32	30	30	33	29	30	38	42	34	30	37	36	43	38	27	30	24	16	15	-2	16	14	6	14	27.7
Logan	35	23	27	32	36	41	56	45	40	31	36	36	40	38	32	38	40	49	50	28	35	28	26	11	20	16	1	18	14	8	19	31 1
Mason City	28	20	24	28	32	37	36	36	34	34	32	34	30	37	37	32	28	33	36	30	21	28	25	28	11	16	16	6	11	16	12	28.4
Maxon	32	15	24	36	36	44	53	32	34	35	33	35	31	43	44	31	29	34	42	49	43	26	31	32	24	19	29	14	18	11	22	31 3
Mechanicsville	32	18	24	29	35	42	48	36	34	34	36	34	36	38	43	30	30	34	38	42	46	33	32	34	28	19	6	8	22	12	18	30.7
Mooar	36	24	26	32	42	42	52	46	31	34	36	37	42	44	47	36	33	37	44	50	48	32	34	39	32	23	8	9	26	19	23	34 3
Monticello	33	18	19	30	30	40	49	32	33	34	34	35	31	39	44	29	26	31	36	43	38	32	33	31	22	16	-2	12	18	10	18	28.0
Mt. Vernon	33	18	23	33	34	44	51	35	34	35	34	35	33	41	47	29	28	32	41	48	39	32	32	30	22	15	0	11	18	8	16	30.0
Newton	33	24	24	35	35	39	53	40	34	35	35	34	40	44	38	29	35	45	46	42	27	30	32	27	24	19	9	10	18	12	17	31 2
Ogden	30	18	26	34	33	36	40	32	34	32	34	34	35	40	42	36	28	36	42	44	40	28	28	28	22	20	6	11	15	7	11	29 2
Omaha, Neb	36	22	32	38	42	44	50	40	32	32	36	36	36	42	45	35	38	42	44	50	46	32	35	32	33	20	-2	16	19	14	24	33 0
Osage	30	12	16	26	36	38	49	32	34	32	34	32	36	39	42	26	23	31	34	40	34	25	29	28	14	10	-6	11	14	6	8	25 3
Osceola	34	18	24	31	36	44	56	37	32	32	34	34	35	40	43	33	28	34	40	44	46	27	32	33	24	20	-4	-1	18	10	16	30 2
Oskaloosa	34	23	28	36	36	39	56	42	36	34	34	36	35	40	46	38	30	36	42	48	42	27	33	32	25	19	0	20	20	12	19	31 7
Ottumwa	35	26	26	41	38	40	57	42	34	35	35	37	38	42	48	40	33	37	44	49	45	32	33	36	30	20	12	10	24	16	22	34 2
Ovid	34	23	27	36	40	42	56	31	34	36	34	34	38	42	48	34	33	38	43	43	43	24	32	32	28	22	0	12	24	15	22	32 3
Panama	33	21	34	26	32	40	36	38	30	32	34	34	34	38	41	36	32	36	38	46	43	30	33	30	22	16	4	12	17	10	12	30 0
Richland	31	16	21	35	34	40	49	38	32	35	34	35	36	43	42	33	34	34	42	46	42	32	35	33	24	20	4	13	16	12	23	31 2
Rock Rapids	26	26	28	32	32	35	33	34	31	32	34	36	33	44	36	32	37	34	38	42	38	30	30	30	12	14	-5	4	9	10	10	27 6
Rockwell City	25	26	29	34	34	41	43	16	32	32	34	28	34	40	36	17	28	32	40	42	30	26	30	26	19	18	-6	10	15	10	18	26 9
Sac City	34	16	28	34	32	37	45	33	34	34	34	30	36	38	45	30	28	37	40	40	35	24	25	26	16	15	-5	8	16	7	14	27 5
Seymour	34	26	29	39	44	38	56	51	49	35	35	34	35	41	45	38	41	38	42	41	46	30	30	34	27	19	8	8	14	18	13	33 6
Sibley	32	15	27	28	30	37	40	37	30	30	32	33	28	34	28	34	34	38	40	40	24	30	24	24	19	16	-2	8	9	8	16	26 6
Sioux City	32	21	32	35	38	40	37	32	36	32	33	35	34	38	42	30	36	36	36	44	46	38	32	34	29	18	16	-4	15	16	12	30 0
Spirit Lake	30	18	28	38	38	41	40	45	28	30	33	32	37	41	32	36	36	36	38	42	32	32	24	17	18	13	2	10	12	7	11	28 3
Toledo	31	18	22	32	34	38	49	30	33	34	35	34	35	39	42	31	28	34	38	44	42	27	30	32	22	17	2	6	20	10	8	29 0
Villisca	32	22	24	34	37	42	54	38	29	32	34	36	35	40	42	34	34	36	40	46	42	30	34	33	24	20	0	13	18	10	18	31 1
Vinton	32	20	25	35	34	42	50	33	34	35	34	35	34	42	44	30	30	34	40	47	38	28	32	30	22	18	-1	14	20	10	18	30 4
Unionville, Mo	34	20	26	34	44	52	62	38	32	32	35	34	31	38	26	34	44	38	36	40	32	41	37	34	28	2	4	20	24	29	32	32 4
Washington	34	20	22	35	37	40	54	39	32	34	35	34	36	40	44	32	30	44	40	46	46	30	33	35	28	25	4	8	22	14	19	31 4
Waukee	35	25	26	36	36	46	49	44	36	38	36	..	35	42	48	36	32	38	43	47	46	34	28	34	26	20	11	12	20	14	19	32 8
Webster City	26	15	25	30	32	41	42	30	33	33	24	32	28	42	36	30	30	35	38	38	32	30	32	27	20	10	-4	14	17	11	11	27 6
Williams	27	15	24	29	28	36	45	30	32	32	33	28	34	36	41	27	29	34	38	46	36	24	28	24	15	14	-7	14	15	3	13	26 6
Wilton Junction	34	26	20	30	34	38	51	38	34	36	32	32	35	39	44	39	29	34	36	40	43	34	34	35	26	18	10	7	18	13	16	30 9
Winterset	32	18	26	35	37	41	55	36	32	30	33	31	31	40	43	32	30	36	43	46	46	28	30	32	23	18	-4	10	19	10	14	29 6

MAXIMUM AND MINIMUM TEMPERATURE FOR DECEMBER, 1894.

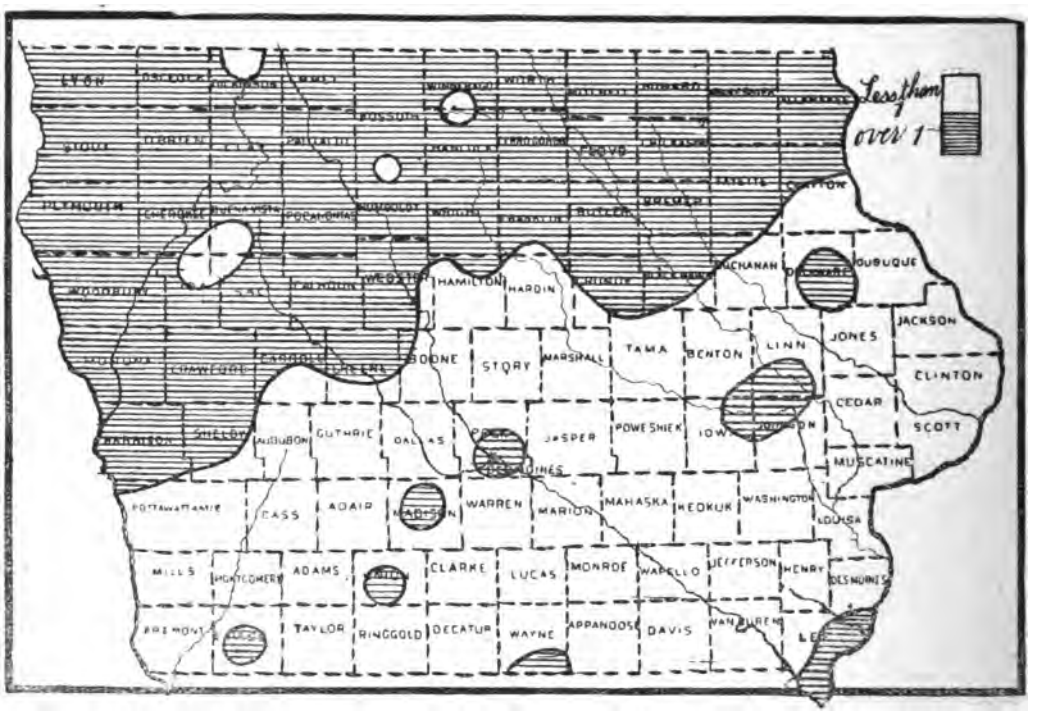
STATIONS.	1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		Mon'y Mean.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Afton	36	32	22	12	35	12	42	18	45	25	52	29	60	47	38	29	35	23	35	29	36	33	27	26	36	24	47	26	46	34	34	30	40	28	40	28	45	32	51	35	56	41	45	41	35	25	31	25	30	15	38	10	-2	- 9	23	- 9	18	11	11	7	25	1	36	1	32.8	
Alta	44	29	27	4	43	14	49	19	50	29	45	32	54	32	32	29	33	27	32	28	36	31	34	25	43	21	50	28	49	33	32	35	41	21	42	30	48	29	52	35	42	24	37	19	34	24	31	15	26	7	32	7	4	-14	23	- 4	19	8	11	2	28	2	35.9	18.9	
Amana	39	33	24	15	32	16	46	18	48	28	50	26	58	46	43	29	36	30	31	38	34	42	25	50	25	47	29	40	34	29	32	29	40	27	49	26	54	33	47	34	31	29	36	30	37	29	30	20	35	10	6	- 1	19	- 3	29	15	15	7	33	2	37.1	23.5	
Ames	35	31	30	10	38	8	49	15	47	30	47	36	61	41	47	28	36	32	37	29	36	30	36	33	43	30	52	32	48	28	45	31	38	18	43	17	54	29	56	29	53	31	33	19	34	18	35	26	30	14	29	16	22	-12	23	-14	24	2	19	14	33	-2	38.8	19.3	
Atlantic	36	28	27	10	40	8	46	10	58	13	51	32	65	45	40	28	35	19	33	30	37	30	35	19	47	18	56	18	44	38	36	27	47	20	43	30	53	21	56	32	52	32	44	21	38	21	31	26	31	15	30	5	7	- 6	35	- 1	27	12	14	2	34	-3	39.6	19.4	
Atlantic (near)	32	30	30	11	39	18	47	20	51	23	50	34	60	47	47	29	35	29	34	30	37	31	34	24	54	27	45	42	45	27	43	32	39	28	42	29	46	37	49	38	41	30	38	28	32	26	35	26	32	18	28	9	14	- 9	26	- 2	25	11	14	6	34	4	38.7	23.0	
Audubon	39	30	31	9	42	10	49	18	50	30	47	29	60	40	39	29	35	29	36	30	37	32	36	26	40	23	52	26	45	35	43	28	43	20	41	31	49	30	53	32	50	32	38	19	38	25	35	25	29	21	26	19	21	-10	23	- 3	23	10	15	4	32	3	38.7	21.9	
Belle Plaine	35	28	25	13	33	11	46	11	42	20	38	29	56	45	42	30	38	30	39	33	38	34	42	20	52	27	47	29	39	33	39	41	43	27	47	32	47	34	31	27	34	27	37	28	39	30	19	24	10	5	- 2	29	- 6	27	9	16	6	33	1	35.8	22.0	
Bonaparte	37	32	35	18	35	13	48	20	48	29	49	28	61	46	51	32	37	27	36	30	37	32	39	34	48	25	55	26	49	41	47	36	43	32	42	25	56	27	59	33	53	41	38	29	38	29	44	31	34	25	28	14	22	0	23	- 2	35	15	24	11	40	2	41.6	24.9	
Carroll	38	21	42	15	40	18	52	18	51	28	52	38	60	38	35	25	36	25	35	28	36	28	38	30	42	20	52	25	48	40	34	20	42	15	51	30	52	38	8	33	5	2	-13	32	- 4	20	13	32	- 4	30	12	5	2	-13	32	- 4	30	12	5	2	38	4	40.8	20.8	
Cedar Falls	34	26	30	10	38	8	48	20	50	32	48	25	57	43	37	29	36	30	39	30	38	32	45	33	45	24	57	24	43	33	31	26	40	18	43	27	54	25	52	33	49	25	30	25	32	26	34	25	25	20	20	7	29	- 5	6	- 6	17	5	24	4	17	2	37.9	20.5	
Cedar Rapids	40	31	35	21	33	15	45	22	44	27	50	26	61	46	44	35	39	36	40	32	39	33	40	34	44	30	51	32	50	42	43	29	38	24	41	32	50	30	54	36	47	35	35	32	38	31	40	34	32	23	26	12	8	5	19	- 1	27	17	17	10	32	9	38.8	26.5	
Charles City	35	29	24	8	34	6	44	14	50	16	48	28	56	46	44	30	36	32	36	32	36	34	44	20	46	24	48	35	40	32	36	24	38	25	38	28	56	33	44	33	30	23	32	26	30	25	30	12	32	6	10	8	50	- 5	27	10	20	2	32	3	37	5	20	7	
Clarinda	36	27	28	15	38	13	47	19	49	23	51	31	62	42	48	30	39	24	32	30	36	31	38	27	42	24	52	24	44	40	41	29	44	24	41	28	49	27	57	34	50	32	38	24	40	29	38	25	29	19	28	9	3	- 7	27	- 2	16	13	19	7	34	3	38.9	22.4	
Clinton	43	30	35	16	38	11	48	15	46	26	51	21	45	40	45	33	35	28	38	32	40	34	38	30	46	28	49	33	53	39	47	28	37	29	40	23	48	32	55	29	50	34	38	27	35	31	38	31	33	30	27	12	19	2	17	- 4	28	19	19	8	27	8	39	0	33.3	
College Springs	38	32	34	13	42	14	50	20	54	24	63	42	29	-	4	49	28	39	31	38	30	32	30	34	26	56	28	50	32	47	36	48	34	47	31	45	24	42	29	59	30	53	25	42	22	40	27	40	28	30	19	30	9	2	- 6	27	- 7	27	11	25	6	38	6	4	- 4	32.0	
Corning	37	31	32	14	40	10	50	20	56	22	53	33	65	50	38	32	37	29	35	32	39	32	37	29	50	32	53	28	47	38	46	32	41	26	41	35	55	28	58	38	56	42	47	21	37	26	42	28	31	17	35	9	20	- 6	28	- 2	32	12	27	7	39	3	42.7	23.1	
Cresco	33	24	25	8	36	7	47	14	45	17	44	27	50	42	32	29	35	30	35	32	35	32	33	29	36	19	43	21	42	35	38	27	42	17	39	27	45	26	49	32	40	28	29	24	32	25	32	24	24	11	22	6	0	- 7	17	- 2	18	10	11	3	26	2	33.0	19.9	
Davenport	38	32	27	30	34	16	46	32	47	31	52	27	55	46	48	35	35	32	40	32	39	34	39	33	47	31	52	29	53	42	36	31	39	24	39	28	51	28	56	38	51	39	39	30	34	30	38	31	34	25	28	15	11	3	17	- 2	28	17	18	10	30	7	38.7	26.3	
Decorah	37	29	22	10	36	3	46	15	45	22	47	23	52	46	56	31	36	29	38	34	36	33	37	31	37	24	48	23	45	36	40	32	34	24	46	18	48	24	50	32	50	36	30	26	36	28	34	24	24	13	22	6	1	- 6	12	10	19	12	18	9	22	5	35.4	22.0	
Des Moines	38	32	28	15	38	15	51	23	49	29	51	33	65	48	43	34	38	34	40	32	39	34	38	35	46	27	50	30	47	44	36	32	42	24	45	32	58	32	57	38	50	40	34	22	37	24	37	30	34	20	34	11	3	- 8	26	- 3	26	14	14	10	37	4	39.9	25.4	
Dubuque	37	32	37	15	36	14	48	20	47	29	49	25	56	45	52	32	37	30	40	32	38	33	37	34	46	32	52	27	52	41	48	30	46	28	49	33	53	39	57	45	53	56	55	33	52	32	39	31	34	31	36	30	32	20	29	12	20	4	16	- 5	26	15	25	9	30	9	40.0	24.6	
Emmetsburg	44	29	32	6	48	12	52	10	52	11	46	24	46	34	37	29	24	29	34	30	36	30	35	28	48	24	52	26	51	31	31	33	37	15	44	21	58	24	50	35	43	11	37	12	31	24	30	17	32	8	30	1	5	-14	27	0	21	10	12	1	39	5	37.4	18.3	
Elkader	36	25	30	10	39	6	48	15	49	21	48	17	54	43	40	29	37	32	40	31	38	32	35	32	44	24	60	25	50	41	44	29	46	28	48	33	52	29	53	37	46	32	38	28	38	27	35	27	32	17	35	5	8	- 5	17	- 6	25	13	14	6	34	5	37.3	20.6	
Fairfield	36	31	36	16	31	11	45	16	45	22	48	26	61	44	50	30	38	27	38	31	38	32	38	32	43	24	60	25	50	41	44	29	46	30	46	41	52	25	56	39	52	39	39	28	40	31	33	29	35	25	21	21	1	20	3	28	11	12	5	37	3	39.9	23.3	
Forest City	35	27	40	4	25	13	44	10	50	14	46	22	47	31	53	25	41	33	36	30	35	30	36	31	35	19	42	22	53	25	47	25	29	11	35	13	41	23	47	25	50	34	38	14	32	14	33	23	28	8	22	4	29	-13	5	-13	20	8	20	0	12	-2	35.7	16.4	
Galva	43	36	49	7	43	12	49	17	53	18	45	21	54	31	47	25	34	25	32	29	36	31	35	31	44	28	50	25	50	44	42	26	42	26	46	30	48	29	58	35	48	35	40	30	31	9	33	8	14	-12	24	- 5	20	10	14	2	29	2	39	3	19.7	
Glenwood	38	30	32	12	56	10			56	16	52	34	50	42	48	30	36	18	44	32	38	32	32	26	48	22	58	25	50	40	40	28	50	32	46	30	54	24	62	40	54	31	46	21	44	28	38	26	30	18	20	0	0	-10	30	- 4	24	2	18	5	28	4	41.4	20.8	
Greenfield	37	29	31	11	39	11	47	20	52	20	52	34	63	45	48	27	39	25	39	30	40	31	40	30	44	27	42	29	51	28	57	35	52	32	49	19	47	25	57	37	27	30	14	30	11	12	-10	25	- 3	25	10	3	3	44	1	1	1	1	1	1	1	1	41.1	21.5	
Grundy Center	38	10	25	11	37	17	49	23	48	26	49	39	60	27	38	28	38	29	37	30	37	33	33	28	42	23	50	36	47	30	31	19	38	28	42	25	51	34	54	40	44	26	31	26	32	30	33	14	28	7	27	-5	0	- 5	20	14	22	4	13	0	33	3	36.5	20.8	
Hampton	34	22	26	6	41	8	50	16	48	19	47	27	58	38	35	25	38	29	35	28	35	31	38	32	42	22	53	25	48	38	43	25	52	20	53	27	46	32	61	38	55	33	40	25	31	16	33	23	31	31	38	11	27	3	8	-10	20	7	20	10	12	1	29	0	35.3	17.8	
Hopeville	36	29	30	14	37	13	49	21	51	24	51	32	64	49	49	28	39	29	34	29	35	31	35	31	43	26	51	28	46	39	46	29	46	24	42	28	53	29	54	34	51	35	36	24	35	27	35	27	27	17	31	11	18	- 8	25	- 2	29	12	18	6	25	4	39.7	22.9	
Independence	31	21	35	10	31	9	46	15	45	23	47	19	56	41	55	29	35	29	37	28	37	30	35	31	43	23	51	23	49	33	34	29	39	19	40	23	52	33	51	29	49	36	39	24	33	24	34	27	30	15	28	6	24	0	18	- 6	21	13	22	4	32	0	38.3	20.3	
Indianola	35	20	30	13	39	13	50	21	5	25	51	32	66	49	52	30	38	30	36	29	36	31	36	32	44	25	54	29	51	38	45	31							51	39	57	38	57	42	46	19	36	24	37	29	33	12	33	10	6	- 9	30	- 3	26	12	25	7	38	2	40.8	22.9	
Iowa City	37	30	28	16	35	10	48	15	50	22	58	24	52	44	46	27	35	30	39	30	38	32	38	33	46	26	53	23	50	39	47	30	39	21	40	25	54	25	50	41			41	30	35	29	40	32	34	32	30	12	25	3	30	- 3	29	15	23	7	35	4	39.8	23.2	
Iowa Falls	35	17	28	7	38	5	50	12	47	17	47	27	58	40	41	26	38	30	37	27	38	31	38	32	42	21	50	25	45	38	46	30	40	23	44	32	55	33	49	26	30	19	30	24	33	33	35	28	32	21	27	4	14	-11	21	- 7	21	12	14	3	30	0	37.4	18.9	
Keokuk	38	34	38	20	34	17	50	24	49	34	52	32	61	47	51	39	35	39	37	37	38	34	40	34	50	30	57	32	54	44	43	33	40	26	45	29	55	32	60	41	55	44	34	31	38	31	45	33	35	28	35	18	12	3	21	- 2	36	15	24	14	38	5	41.4	25.8	
Keosauqua	37	33	37	32	38	15	50	23	52	30	47	28	63	47	52	36	40	30	38	32	39	34	39	35	49	28	56	27	50	44	48	32	44	23	43	32	56	28	59	37	54	43	44	29	39	30	44	33	33	25	30	16	25	3	33	0	33	16	27	12	45	5	43.1	26.4	
Knoxville	36	30	30	13	38	14	50	21	36	25	54	32	73	43	36	30	38	32	37	29	39	32	37	32	37	26	47	28	44	42	33	30	38	32	42	30	52	31	54	35	48	40	37	32	35	34	29	35	18	25	10	1	- 5	30	- 3	24	13	13	8	34	4	37.6	23.8	
La Crosse (Wis.)	36	24	26	12	39	10	48	22	45	27	49	26	54	42	42	32	40	32	39	34	35	32	36	32	42	30	50	30	46	38	37	27	36	21	45	29	51	26	54	34	46	32	39	28	36	26	36	27	35	16	22	16	10	- 4	21	- 6	21	14	15	8	27	16	37.0	23.2	
Larrabee	42	17	28	8	45	11	47	17	51	16	45	30	50	30	38	27	33	28	31	28	35	31	35	23	41	20	49	26	51	32	44	24	43	17	45	29	54	18	52	34	50	26	39	15	35	24	35	14	27	4	24	6	9	-14	26	6	21	7	12	1	28	1	37.5	18.0	
Logan	40	30	36	10	40	14	51	12	54	19	50	32	42	30	54	36	50	30	32	30	40	32	42	30	54	26	53	24	50	35	40	28	40	20	45	32	50	30	60	35	58	41	36	21	42	28	34	22	28	18	14	8	10	- 8	28		5	20	8	12	5	35	2	40.2	22.0	
Mason City	36	19	36	5	41	7	48	7	45	18	45	29	45	25	46	29	37	30	35	30	36	30	39	20	50	24	45	29	35	32	42	30	46	26	46	27	54	29	53	32	53	28	34	23	28	28	28	22	37	23	24	8	28	4	15	-11	18	- 6	20	2	30	0	25	-1	36.1	16.6	
Mechanicsville	36	29	25	11	33	14	45	13	45	25	53	30	52	44	42	31	39	30	38	31	38	33	36	33	44	27	51	25	50	36	34	26	38	23	45	24	50	24	51	32	48	43	35	31	34	31	36	32	33	22	29	11	10	2	20	- 3	18	17	17	8	32	3	37.6	23.9	
Mooar	38	34	28	20	34	17	40	24	49	34	52	32	64	40	52	29	35	27	39	3	38	34	44	30	55	30	57	32	54	40	43	34	40	26	45	29	55	32	60	40	55	40	34	30	38	30	45	33	35	28	28	18	12	3	20	- 4	25	12	18	5	33	1	41.5	27.0	
Newton	35	31	35	14	35	12	49	21	45	25	48	30	62	44	49	31	35	34	40	30	38	32	37	33	42	25	53	27	48	40	46	30	38	26	43	27	53	30	56	36	53	30	31	33	35	35	36	28	31	17	27	9	25	- 7	23	- 4	25	12	18	5	33	1	37.5	22.9	
Ogden	37	24	30	7	44	7	52	15	50	16	47	26	64	36	42	33	36	31	35	28	37	30	36	31	50	20	55	25	47	36	44	28	40	17	45	28	59	24	56	32	57	28	39	16	33	32	32	32	31	22	35	4	25	-13	28	- 6	25	5	13	1	25	-3	40.2	18.4	
Omaha (Neb.)	40	32	28	15	46	19	52	24	55	28	52	36	60	41	45	35	40	24	34	30	38	32	42	24	55	28	49	41	39	31	47	29	51	33	55	31	60	39	52	40	37	36	42	28	37	36	42	28	38	16	28	11	5	- 8	32	- 5	24	14	21	8	37	10	41.8	25.1	
Oskaloosa	36	31	32	14	37	9	52	20	48	24	49	29	65	46	53	30	40	32	38	30	37	31	38	33	44	26	54	27	50	42	46	30	40	20	46	27	56	27	59	36	52	32	30	22	39	27	36	28	31	19	28	10	3	- 8	23	- 3	23	13	15	9	37	1	40.1	23.3	
Osceola	36	32	24	13	35	12	42	20	47	25	54	34	62	49	44	30	36	29	36	28	37	32	36	34	48	26	52	28	46	40	45	30	50	30	51	37	59	36	52	32	30	22	39	27	37	29	39	29	32	18	29	12	6	- 8	24	- 4	28	8	20	10	32	0	36.9	23.4	
Ottumwa	38	32	36	17	38	14	48	24	54	28	49	37	66	48	52	32	38	31	40	30	38	32	40	35	49	27	51	28	51	44	48	30	43	23	46	28	59	28	58	39	55	36	37	28	39	27	41	30	38	28	28	13	26	- 1	32	- 2	32	15	22	10	40	4	42.7	25.0	
Ovid	36	31	31	15	41	13	50	22	56	25	51	32	62	49	47	27	40	27	43	30	37	32	36	32	52	27	56	27	46	40	39	28	44	22	46	28	57	29	56	30	56	34	38	21	36	27	36	27	36	20	33	10	4	- 5	26	- 3	33	14	23	8	40	4	41.2	23.3	
Panama	34	31	31	11	38	31	38	14	43	22	49	31	57	34	45	30	37	33	33	30	36	32	38	30	44	23	51	25	46	36	44	28	42	23	43	30	49	28	56	36	52	34	40	21	40	26	34	25	30	13	36	6	16	- 9	26	- 3	33	12	14	6	32	2	38.0	22.0	
Rockwell City	41	9	42	12	42	16	50	18	49	30	49	31	60	36	36	-2	36	29	34	29	36	32	36	21	45	22	52	27	50	21	31	3	40	16	42	21	50	30	51	34	45	16	34	17	34	26	34	32	9	30	8	21	12	2	-14	20	0	20	10	12	8	25	10	37.1	16.7	
Rock Rapids	30	20	35	16	45	12	50	15	54	20	40	30	46	20	38	30	32	30	35	30	40	28	46	20	51	36	40	32	36	24	46	28	45	32	46	30	51	32	46	33	42	10	40	22	42	19	21	3	21	7	7	-17	15	- 7	20	- 2	22	- 2	20	-1	36.4	18.7	
Sac City	35	23	25	7	44	13	47	20	45	19	48	26	57	33	35	31	36	32	36	32	37	30	36	25	34	23	48	28	48	42	32	27	36	20	43	31	48	32	47	34	38	32	32	15	34	16	32	19	33	8	23	7	4	-14	17	0	19	12	11	3	32	6	34.6	20.4	
Seymour	37	32	35	16	38	10	48	30	55	34	50	25	65	48	60	42	58	40	40	30	38	32	35	32	54	28	50	40	48	28	50	32	55	20	58	25	50	32	58	35	40	20	28	34	20	28	10	20	6	5	20	0	20	- 6	28	10	20	6	42	3	34.9

STATIONS. Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total
Afton											.25				.85																	1.10
Algona						.02					.05					.90																.97
Alta						.07		.03			T				.82	.04										.03						.98
Amana	.25										.25					.64								.30								1.34
Ames (1)							T			.08					.76											.02						.86
Ames (2)							T				.02				.60											.02						.64
Atlantic															.97											T						.97
Atlantic (near)						T					T	T			.70																	.70
Audubon															.75																	.75
Belle Plaine															.80																	.80
Bonaparte										.10					.30								.12									.52
Carroll						.05					.02					.89										T						.96
Cedar Falls								T			T				1.40																	1.40
Cedar Rapids	.18										.30	.01				.67								.03								1.19
Charles City								.05			.30				1.04																	1.39
Clarinda	.07									.05	.23					.64										T						.99
Clinton										.11	.01				.37									.14								.63
College Springs									.25	.15					.36																	.96
Cresco						T		.02		.32					.73																	1.07
Davenport	T						T			.06	.03				.21	.10								.21						T	T	.61
Decorah											.25				1.50																	1.75
Delaware								.05			.11				.82								.05									1.03
Des Moines (1)	.21					T	T			T	.29				.36	.24										.02	.04			T		1.15
Dubuque								T		T	.02				.06	.26								.01						T		.35
Elkader								.03			.22				.41	.25																.91
Emmetsburg						.05	T	.03		T	.01	T			.99	.14										T			T	.11		1.33
Fairfield										T	.13				.41									.10								.64
Forest City						T					T				.73																	.73
Ft. Madison										.50					.38								.24				T					1.12
Galva						.05									.20	.70																.95
Glenwood										.11					.75																	.86
Grand Meadow								.05			.22					.91																1.18
Greenfield	.02										.07				.67	.10										.02			T	T		.88
Grundy Center								T		.07					.95																	1.02
Hampton								T		.16					.86	.38										T			T			1.40
Hawkeye								.20	T		.35				.86	T					T					T	T			T		1.41
Hopeville											.29				.50	.07										T						.86
Hopkinton								.05			.15				.90																	1.10
Humboldt						.06					.10			.30	.60																	1.06
Independence								T			.15				.25	.55													T	T		.95
Indianola	.20									T	.25				.28	.15											.02					.90
Iowa City											.15				.52								.31				.05					.98
Iowa Falls											.16				.45	.28																.89
Keokuk	.12									.34	.01				.31	.03							T	.25			T			T		1.06
Keosauqua	.33									T	T			T	.32									T			T					.65
Knoxville											.10				.65	.15								T			T			T		.90
Larrabee						.09		.04	.02	.10		T			1.04											T						1.29
Logan															.75	.38																1.13
Le Clair										.11					.18									.11								.40
Mason City						.02				.13					.88											.02	T		.01			1.06
Maxon										.10					.15												T					.25
Mechanicsville								.01	T	T	.23				.55									.15								.94
Monticello								.02			.09				.78										.08							.97
Mooar										.83						.12																.95
Newton	.48							T			.13				45	.29										T				T		1.30
North McGregor								T			.20					.60												T				.80
Ogden											.09					.36											.02					.98
Omaha (Neb.)						.02				.02	.02	.01			.47	.38								T		.02						.94
Osage								T			.30				.99	.04										T			T			1.33
Osceola						T					.28					.64											.06					.98
Oskaloosa											.12				.50																	.62
Ottumwa										.04	.16				.38								.08									.66
Ovid											.23				.50								T			T						.73
Panama										.21					1.03																	1.24
Richland										.03	.11				.51								.13				T					.78
Rockwell City						.13	T	T		T	.08				1.10																	1.31
Rock Rapids																1.00										T			T	T		1.00
Sac City						.50		T							1.25											T						1.75
Seymour	T										.20				.70	.30																1.20
Sibley						T		T	T	T	.15	T			T	1.00										T			F	T		1.15
Sioux City						.03	.01	.01		.01	.04	T			.71	.49								T		T				T		1.30
Spirit Lake															.40	.50																.90
Toledo											.18				.70																	.88
Unionville (Mo.)	.05									.08	.01	T			.31												.06					.51
Villisca										.13					.42	.33										T						.88
Vinton											.10				.64	T																.74
Washington											.06					.48								.18								.72
Webster City						T					.10					.80										T						.90
Waukee											.28				.61																	.89
Williams										.09					1.00											.09						1.18
Wilton	T									T					.70														T		T	.70
Winterset							.10			.18	25			.50													T					1.03

MEAN TEMPERATURE DEC. 1894.



IOWA PRECIPITATION CHART DEC. 1894.



METEOROLOGICAL STATIONS AND OBSERVERS.

From the following, weekly and monthly reports of Meteorological data are received by the Iowa Weather and Crop Service.

Afton	Hon. N. W. Rowell.
Albia	Cal Koontz.
Albia (Maxon)	Gus Johnson.
Algona	C. D. Pettibone.
Alta	D. E. Hadden.
Amana	Conrad Schadt.
Ames (Exp. Station)	W. H. Hellеman.
Atlantic	J. W. Love.
Atlantic	Geo. W. Franklin.
Audubon	J. F. Hocker.
Bancroft	J. A. Frech.
Belle Plaine	H. W. Vandike.
Blakeville	James Rodgers.
Bonaparte	Hon. B. R. Vale.
Carroll	Moses Simon.
Cedar Falls	Prof. A. C. Page.
Cedar Rapids	H. D. Olds.
Centerville	Prof. H. E. Reister.
Charles City	J. W. Smith.
Clarinda	A. S. Van Sandt.
Clinton	Luke Roberts.
College Springs	A. A. Berry.
Corning	John W. Bixby.
Cresco	Gregory Marshall.
Davenport	*F. J. Walz.
Delaware	Wm. Ball.
Decorah	F. H. Baker.
Denison	M. E. Lies.
Des Moines	*Geo. M. Chappel, M. D.
Dubuque	*T. W. Ruete.
Eldora	Prof. C. F. Woodward.
Elkader	Chas. Reinecke.
Emmetsburg	J. A. Carmichael.
Fairfield	Charles J. Fulton.
Fayette	R. Z. Latimer.
Ft. Madison	Miss L. A. McCready.
Forest City	J. A. Peters.
Galva	W. A. Crowley.
Glenwood	Seth Dean.
Greenfield	J. G. Culver.
Grinnell	Prof. S. J. Buck.
Grundy Center	Geo. F. Ellis.
Hampton	E. C. Grenelle.
Hawkeye	J. W. Bopp.
Hopeville	M. T. Ashley.
Hopkinton	Theo. Marks
Humboldt	H. S. Wells.
Independence	E. F. Wulfke.
Indianola	Prof. J. L. Tilton.
Iowa City	Prof. A. L. Arner.
Iowa Falls	J. B. Parmelee.
Jefferson	Dr. Chas. Enfield.
Keokuk	*Fred. Z. Gosewisch.
Keosauqua	Prof. J. H. Landes.
Knoxville	Casey and Reeves.
Larrabee	H. B. Strever.
Logan	Mrs. M. B. Stern.
Mason City	H. I. Smith.
Marshalltown	C. M. Cook.
Maquoketa	Dr. A. B. Bowen.
Mechanicsville	Rev. J. W. Hubbard.
Moar	F. G. Thomas
Monticello	Henry D. Smith
Mount Vernon	Prof. A. Collin.
Mt. Ayr	Hon. Wm. Shriver.
Mt. Pleasant	Dr. Max E. Witte.
Newton	A. Lufkin.
Ogden	E. Sayre.
Omaha, Neb	*L. A. Welch.
Osceola	A. W. Lewis.
Ovid	H. C. Miller.
Osage	G. D. Pattingill.
Oskaloosa	Jos. Boyd.
Ottumwa	L. J. Baker
Panama	Wm. J. Wicks.
Postville	F. L. Williams.
Richland	Wm. A. Shaffer.
Rock Rapids	W. C. Wyckoff.
Rockwell City	G. B. Rigg.
Seymour	Mrs. C. A. Conger.
Sibley	H. G. Doolittle.
Sidney	G. V. Swearingen.
Sioux City	*U. G. Pursell.
Sac City	Dr. C. Brown.
Spirit Lake	W. C. Drummond.
Sutherland	W. H. Bloom.
Toledo	Chas. Mason.
Vinton	T. F. McCune.
Villisca	J. F. McCartney.
Washington	Wm. A. Cook.
Waukee	John Wragg.
Webster City	C. M. Trumbauer.
Wilton Junction	J. M. Rider.
Winterset	Will McKnight.
West Bend	Phil. Dorweiler.
Williams	M. L. Fuller.

*U. S. Weather Bureau.

WEATHER-CROP OBSERVERS.

Reporting for the Weekly Bulletin.

Afton	M. V. Ashby.
Agency	J. H. Van Zant.
Albia	Wm. Mercer.
Alta	Hon. H. T. Saberson.
Ames	Henry C. Wallace.
Anita	H. T. Chapin.
Ankeny	Ed. Parmenter.
Battle Creek	A. Preston.
Bloomfield	Geo. Duffield.
Boone	L. C. Morris.
Bristow	G. W. Wells.
Carson	G. N. Ferguson.
Centerville	Lewis Phillips.
Charles City	W. B. Towner.
Chariton	C. C. Burr.
Clarksville	F. M. Russell.
Corning	Jerome Smith.
Clermont	Chas. Larrabee.
Concord	J. M. Elder.
Council Bluffs	L. Prouty.
Dedham	J. A. Horton.
Danville	Sherman Matthews.
Emerson	D. B. Nims.
Ely	Hon. A. J. Fuhrmeister.
Fulton	Carl S. Frank.
Fontanelle	Hon. L. M. Kilburn.
Ford	J. C. Richards.
Fort Dodge	R. W. Blaine.
Geneva	Wm. H. Thompson.
Grinnell	A. O. Price.
Guthrie Center	W. W. Bailey.
Hesper	G. E. Dillingham.
Hodge	James Piper.
Hamlin	F. P. Moore.
Humeston	Hon. S. H. Moore.
Independence	C. L. Thomas.
Indianola	T. B. Hammer.
Knoxville	B. F. Bauta.
Larrabee	H. H. Carnahan.
LeMars	Hon. Henry Schrooten.
Ledyard	Frank Miller.
Lawler	Hon. Wm. Glattly.
Lockridge	John F. Farman.
Manning	H. W. Pollock.
Mapleton	A. Lamb.
Marshalltown	Hon. J. G. Brown.
Mason City	Wm. Nettleton.
Mt. Pleasant	W. S. Wright.
Milton	Hon. E. C. Holland.
Mount Vernon	Robert Smith.
Newton	J. P. Beatty.
North English	J. L. Williams.
Nevada	O. G. Ashford.
Osage	E. W. Stacy.
Orange City	H. J. VandeWaa.
Paton	A. B. Condit.
Pittsburg	G. C. Duffield.
Polo Station	A. E. Miller.
Prescott	G. W. Iden.
Paullina	Stephen Harris.
Rockwell City	J. G. Palmer.
Rock Rapids	D. E. F. Merrill.
Rossville	F. B. Wiley.
Sandusky	Z. Hollingsworth.
Sageville	Hon. F. N. Knoll.
Seymour	J. F. Wagner.
Shenandoah	Reuben Mullison.
Spirit Lake	C. E. Abbott.
State Center	E. N. Thompson.
Sumner	John Dawson.
Tama	W. G. Malin.
Unity	Edw. Hummer.
Van Horn	Spencer Smith.
Wapello	O. P. Smith.
Wheatland	D. Beckman.
Willow Creek	W. S. Nicholson.
Winterset	H. A. Klusman.
Wall Lake	P. E. Wilcox.
Walnut	F. L. Martin.
What Cheer	O. D. Lawrence.

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